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INDIAN AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI.

I. A. R. I. 6.

MGIPC—S1—51 AR/57—3-4-58—5,000.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY
SIR A. SMITH WOODWARD, LL.D., F.R.S., F.G.S.,
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VOL. VI.—TENTH SERIES.

LONDON:
PRINTED AND PUBLISHED BY TAYLOR AND FRANCIS.
1930.

" Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—Linnæus.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—Bruckner, *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. Taylor, *Norwich*, 1818.

ALERE FLAMMAM.

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THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

> "................ per litora spargite muscum
> Naiades, et circùm vitreos considite fontes:
> Pollice virgineo teneros hìc carpite flores:
> Floribus et pictum, divæ, replete canistrum.
> At vos, o Nymphæ Craterides, ite sub undas
> Ite, recurvato variata corallia trunco
> Vellite muscosis e rupibus, et mihi conchas
> Ferte, Deæ pelagi, et pingui conchylia succo."
> *N. Parthenii Giannettasi*, Ecl. 1.

No. 31. JULY 1930.

I.—*Four new Trichostrongylid Nematodes from Queensland.* By H. A. Baylis, M.A., D.Sc.

(Published by permission of the Trustees of the British Museum.)

The four species to be described in this paper were found among the helminthological material from the collection of the Australian Institute of Tropical Medicine, Townsville, North Queensland, kindly forwarded to the writer by Dr. G. M. Heydon.

Co-types will be deposited in the British Museum (Natural History) and in the School of Public Health and Tropical Medicine, Sydney, N.S.W.

1. *Anoplostrongylus heydoni*, sp. n. (Figs. 1–5.)

The genus *Anoplostrongylus* was erected by Boulenger (1926) for the reception of two species which he rightly considered should be excluded from the genus *Histiostrongylus*, Molin, 1861. These were *Histiostrongylus paradoxus*, Travassos, 1921 (designated by Boulenger as genotype of *Anoplostrongylus*), and *H. tipula* (van Beneden, 1873). Schwartz (1927) has added another species, *Anoplostrongylus* *delicatus*, and given a diagnosis of the genus. The species described by Monnig (1927) under the name of *Histiostrongylus ornatus* is, in the writer's opinion, also clearly referable to *Anoplostrongylus*.

The species now to be described was collected by Mr. A. J. Bearup at Townsville, North Queensland, in September 1928, from the intestine of a bat believed to be *Miniopterus schreibersi*, Natt.

Fig. 1.

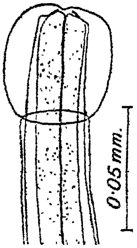
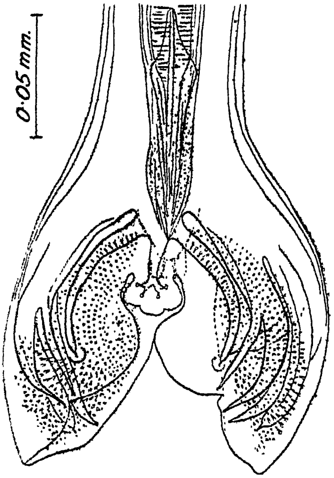


Fig. 2.

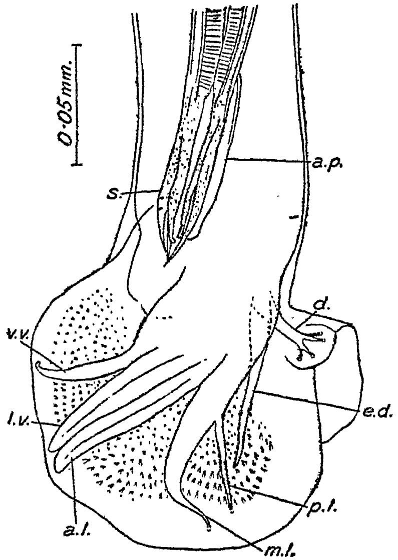


Anoplostrongylus heydoni, sp. n.
Fig. 1.—Anterior end of female; lateral view.
Fig. 2.—Posterior end of male; dorsal view.

The male measures 3·3–3·8 mm. in length, the female 4·4–4·5 mm. The maximum thickness is about 0·07 mm. in the male and 0·08 in the female. The cuticle of the body bears a number of longitudinal crests. Of these there appear to be 14–16 in the more anterior part of the body, where they are prominent and show a pectinated structure. Posteriorly the crests become more numerous, but less conspicuous. There is an almost spherical cuticular swelling at the anterior extremity (fig. 1). The transverse diameter of this is 0·048–0·05 mm., and its length 0·045–0·05 mm. The diameter of the head, excluding the cuticular inflation, is 0·02–0·023 mm. The œsophagus is about 0·26–0·32 mm. long, and is simple and club-shaped. The nerve-ring (in the female) is situated at about 0·15 mm. from the anterior end.

The bursa of the male (figs. 2 and 3) consists of a small dorsal lobe and two large lateral lobes. A considerable area of the inner surface of the lateral lobes is covered with sharp spines. The arrangement of the rays is similar to that found in other described species of the genus. The small terminal branches of each half of the dorsal ray are rather widely divergent, however, and not closely apposed as in *A. delicatus*, Schwartz, and *A. ornatus* (Monnig). There is a well-developed genital cone (fig. 4) having on its dorsal side a membranous expansion supported by two slender papilla-like processes. The spicules are 0·24–0·25 mm. long. For the greater part of their length they are tubular and provided with broad, finely striated alæ. Near its tip each spicule appears to split into three processes, two of which are sharply pointed, the third shorter and blunt. There is an accessory piece, apparently shaped rather like a pen-nib, and measuring about 0·085 mm. in length.

Fig. 3.



Anoplostrongylus heydoni, sp. n. Posterior end of male; lateral view.
a.l., antero-lateral ray; *a.p.*, accessory piece; *d.*, dorsal ray; *e.d.*, externo-dorsal ray; *l.v.*, latero-ventral ray; *m.l.*, medio-lateral ray; *p.l.*, postero-lateral ray; *s.*, spicule; *v.v.*, ventro-ventral ray.

The tail of the female (fig. 5) is of the shape characteristic of the genus, with a median terminal spike and three shorter and blunter processes, one of which is dorsal and two subventral. The vulva is situated at 0·95–1 mm. from the posterior end. The uterine branches are opposed, the two ovejectors having a combined length (including the sphincters) of about 0·25 mm. The eggs measure 0·075–0·09 mm. × × 0·04–0·05 mm. and are unsegmented *in utero.*

Fig. 4.

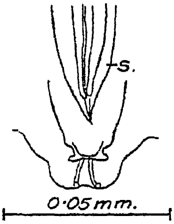
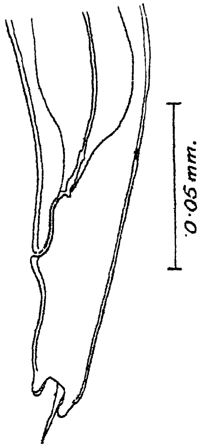


Fig. 5.



Anoplostrongylus heydoni, sp. n.

Fig. 4.—Genital cone of male; ventral view. *s.*, tips of spicules.
Fig. 5.—Posterior end of female; lateral view.

The form just described differs only in very slight characters from the previously known species of the genus. A comparative table of the measurements of the five species is given on p. 5. In size the present species is nearest to *A. ornatus* (Monnig), from which it differs in being more slender, and in the form of the dorsal ray of the male, as has been remarked above. *A. delicatus*, Schwartz, is somewhat larger than *A. ornatus*, and in this form again the dorsal ray differs in shape from that of the present species. The subglobular shape of the cephalic cuticular swelling in the new species is another character in which it appears to differ from both these forms. *A. tipula* (v. Beneden) is a very imperfectly described species, van Beneden having given no measurements except those of total length. It seems, however, to be a very small form. As regards *A. paradoxus* (Travassos), the measurements alone (especially the length of the spicules of the male) are sufficient to distinguish this species from the form now described.

Species of Anoplostrongylus (*measurements in mm.*).

Species.	*paradoxus* (Travassos, 1921).		*tipula* (v. Beneden, 1873).		*delicatus*, Schwartz, 1927.		*ornatus* (Monnig, 1927).		*heydoni*, sp. n.	
	♂.	♀.	♂.	♀.	♂.	♀.	♂.	♀.	♂.	♀.
Length	3–4	6–8	about 1·0	1·5–2	4·25	5·7	3·8	4·8	3·3–3·8	4·4–4·5
Maximum thickness	0·085	0·17–0·21	..	..	0·12	0·095	0·094	0·118	0·07	0·08
Diameter of head (including cuticular inflation)	0·037	0·12	..	..	0·038	0·047	0·031	0·033	0·048–0·05	
Length of cuticular inflation	0·012–0·035		..	..	0·046–0·05	0·07	0·051	0·054	0·045–0·05	
Anterior end to end of œsophagus	0·184–0·497		..	..	0·35	0·352	0·294	0·322	0·26–0·32	
Length of spicules	0·12	..	..	..	0·17	..	0·255	..	0·24–0·25	
„ accessory piece	0·035	..	..	..	0·055	..	0·07	..	0·085	
Tail of female, length	..	0·085–0·092	..	..	..	0·084–0·11	..	0·051	..	0·058–0·065
Vulva from posterior end	..	1·9	..	..	..	1·45	..	1·08	..	0·95–1·0
Ovejectors, combined length	..	0·42	..	..	..	0·403	..	..	..	0·25
Eggs, length	0·092–0·099		..	..	0·063–0·075		0·09		0·075–0·09	
„ width	0·056–0·063		..	..	0·042		0·047		0·04–0·05	
Hosts	"Molossinæ."		*Myotis daubentonii*, *Vespertilio murinus*, *V. noctula*.		"Brown bat."		*Eptesicus capensis*.		*Miniopterus schreibersi* (?).	
Geographical distribution	Brazil.		Europe.		Texas.		S. Africa.		Queensland.	

2. *Nycteridostrongylus uncicollis*, gen. et sp. n.*
(Figs. 6–11.)

This form was collected by Mr. J. W. Fielding in April 1911 from the intestine of a bat (? *Miniopterus* sp.). No locality is mentioned, but it was presumably in the Townsville district.

The male measures 5–5·5 mm. in length, the female 6·1–6·9 mm. The maximum thickness is 0·16–0·17 mm. in the male and 0·19–0·24 mm. in the female. The anterior end of the body, in the preserved specimens, is invariably hooked ventrally in the manner shown in fig. 6, and the cervical region bears a conspicuously striated ventral cuticular flange (fig. 6, *f.*) which originates immediately behind the cephalic cuticular inflation and gradually widens posteriorly. This flange, in all the specimens, invariably consists of four sections. The first extends from the cephalic inflation to the excretory pore, and is very narrow. The three others have the form indicated in the figure. The cephalic inflation shows irregular transverse wrinkles, and extends

Fig. 6.

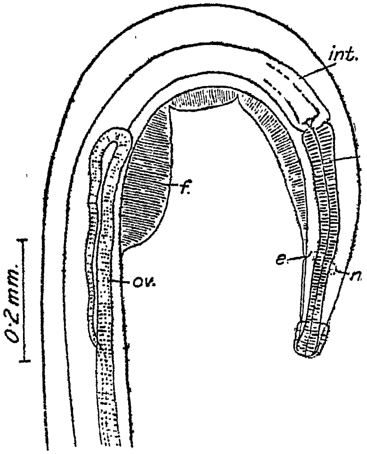
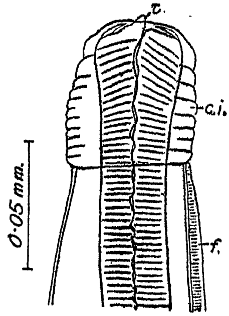


Fig. 7.



Nycteridostrongylus uncicollis, gen. et sp. n.

Fig. 6.—Anterior end of female; lateral view. *e.*, excretory pore; *f.*, ventral flange; *int.*, intestine; *n.r.*, nerve-ring; *oes.*, œsophagus; *ov.*, ovary.

Fig. 7.—Anterior end of female; lateral view. *c.i.*, cuticular inflation; *f.*, ventral flange; *t.*, dorsal tooth.

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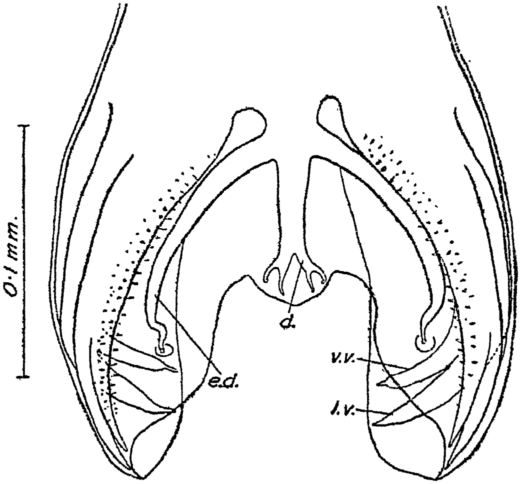
* For generic diagnosis, see p. 9.

slightly further back on the dorsal than on the ventral surface. Its greatest length is 0·055–0·065 mm. The cuticle of the body is finely transversely striated, and also bears numerous crests, having a pectinated appearance, which do not run longitudinally, but *obliquely* from the dorsal and ventral lines to the lateral lines. This arrangement of the crests gives the worm a very characteristic appearance under moderately high magnification.

The diameter at the cephalic extremity, including the cuticular inflation, is 0·045–0·05 mm., and excluding the inflation 0·03–0·04 mm. There is a very shallow buccal capsule, containing a large, blunt, protrusible tooth (fig. 7, *t.*) which arises from the dorsal side of the entrance to the œsophagus. The club-shaped œsophagus is 0·33–0·39 mm. long in the male, 0·36–0·44 mm. in the female. The nerve-ring is situated at 0·15–0·16 mm., and the excretory pore at 0·16–0·18 mm., from the anterior end.

Fig. 8.

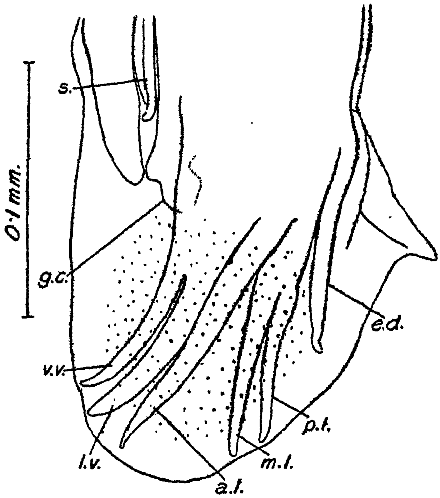


Nycteridostrongylus uncicollis, gen. et sp. n.
Bursa of male; dorsal view.

d., dorsal ray; *e.d.*, externo-dorsal ray; *l.v.*, latero-ventral ray; *v.v.*, ventro-ventral ray.

The bursa of the male (figs. 8 and 9) has two symmetrical lateral lobes and a small dorsal lobe. The lateral lobes are rather narrow, and project in a direction almost parallel to the longitudinal axis of the body. A large portion of their inner surfaces is covered with small spines. The dorsal ray is rather stout, and bifurcates distally, each branch being again bifurcate. The externo-dorsal rays originate from the main stem of the dorsal ray, near its base. The postero-lateral ray does not diverge greatly from, and is not much more slender than, the medio-lateral ray. The antero-lateral, latero-ventral, and ventro-ventral rays are all fairly close together, the tip of the latero-ventral ray being nearer to that of the ventro-ventral than to that of the antero-lateral. There is a pair of prebursal papillæ. The genital cone (fig. 9, *g.c.*, and fig. 10) carries two conical papilla-like processes, one behind the other, on its ventral surface, and is produced dorsally into a membranous expansion supported by two slender processes. The spicules appear to be very similar to those of *Anoplostrongylus heydoni*. They measure about 0·6 mm. long, and are tubular, with transversely striated alæ, except near the tips, where they appear to be split into several processes. The precise number and form of these could not be made out in the specimens available. A vaguely-defined and imperfectly chitinized accessory piece appears to be present.

Fig. 9.

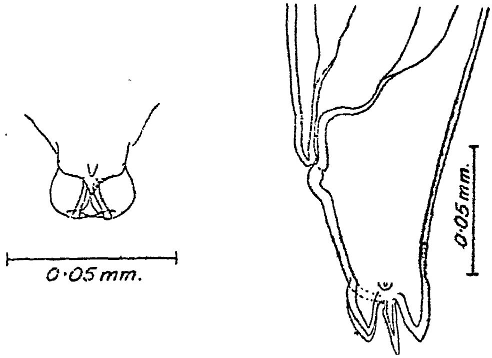


Nycteridostrongylus uncicollis, gen. et sp. n.
Bursa of male; lateral view.

a.l., antero-lateral ray; *e.d.*, externo-dorsal ray; *g.c.*, genital cone; *l.v.*, latero-ventral ray; *m.l.*, medio-lateral ray; *p.l.*, postero-lateral ray; *s.*, spicules; *v.v.*, ventro-ventral ray.

The tail of the female (fig. 11) measures about 0·0875 mm. in length and is similar in shape to that of *Anoplostrongylus*, with a terminal spike and three relatively large conical processes, one of which is dorsal and two subventral. There is also a pair of lateral papillæ close to the bases of these processes. The vulva is situated at 1·62–1·86 mm. from the posterior end, and is not prominent. The genital tubes are paired and opposed, the two ovejectors having a combined length (including the sphincters) of about 0·35 mm. The eggs measure 0·0875–0·105 mm. × 0·05–0·0625 mm. Their contents are in early stages of segmentation *in utero*.

Fig. 10. Fig. 11.



Nycteridostrongylus uncicollis, gen. et sp. n.

Fig. 10.—Genital cone of male; ventral view.
Fig. 11.—Posterior end of female; lateral view.

This form differs in a number of characters from the species of *Anoplostrongylus*. Among these may be mentioned the presence of the ventral flange in the cervical region, the oblique arrangement of the crests on the cuticle of the body, the form of the bursa and the arrangement of its rays in the male. It is proposed to make the species the type of a new genus, which may be defined as follows:—

NYCTERIDOSTRONGYLUS, gen. nov.

Trichostrongylinæ: body with cuticular crests running obliquely from the dorsal and ventral to the lateral lines. Cuticle of head slightly inflated. A ventral cuticular flange present in the cervical region. A shallow buccal capsule present, containing a large protrusible dorsal tooth. Bursa with symmetrical lateral lobes and a small dorsal lobe. Ventro-ventral, latero-ventral, and antero-lateral rays all rather close together. Medio-lateral ray widely divergent from antero-lateral, but less so from postero-lateral, which is nearly equal to it in thickness. Externo-dorsal rays originate from main stem of dorsal ray, near its base. Dorsal ray bifurcate distally, and each of the branches again bifurcate. Prebursal papillæ present. Spicules elongate, tubular and alate proximally, divided distally into two or more processes. An accessory piece apparently present. Tail of female truncate, with a terminal spike and three conical processes. Vulva towards posterior end of body. Eggs segmenting when deposited.

Genotype.—*Nycteridostrongylus uncicollis*, sp. n.

Hab.—Intestine of a bat.

3. *Nicollia tachyglossi*, gen. et sp. n.* (Figs. 12–18.)

This and the following species were found together in the intestine of an Echidna (*Tachyglossus aculeatus*) by Dr. W. Nicoll. The locality is not stated.

The length of the male is 3·65–4·6 mm., that of the female 3·9–4·4 mm. The maximum thickness is 0·11–0·14 mm. in the male and 0·1–0·13 mm. (at the vulva) in the female. The cuticle of the body is marked with fine transverse striations and with ten or twelve slight, transversely striated, longitudinal crests in both sexes. There are no prominent lateral alæ. At the anterior end (fig. 12) there is a very slight inflation of the cuticle, extending for a distance of 0·095–0·11 mm. from the extremity.

There is an extremely shallow, ring-like buccal capsule. At the base of this a large conical tooth (filling up a considerable portion of the cavity) arises from the dorsal side of the entrance to the œsophagus. This tooth can be protruded through the mouth-opening. The œsophagus is slightly expanded at its anterior end, then becomes cylindrical and rather narrow, and expands again posteriorly to form a well-marked "club." Its length is 0·25–0·32 mm. in the male and 0·3–0·35 mm. in the female. The nerve-ring is situated somewhat behind its middle.

The bursa of the male (fig. 13) has two symmetrical lateral lobes and no distinct dorsal lobe. The dorsal ray (fig. 14) is very delicate and often difficult to see, its terminations being frequently hidden in a fold of the bursal membrane. It is divided for nearly one-third of its length

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* For generic diagnosis, see p. 17.

Fig. 12.

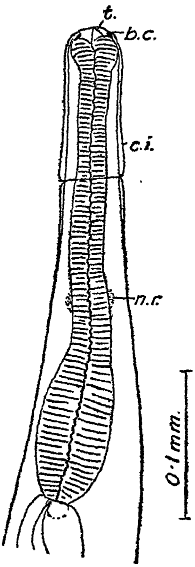
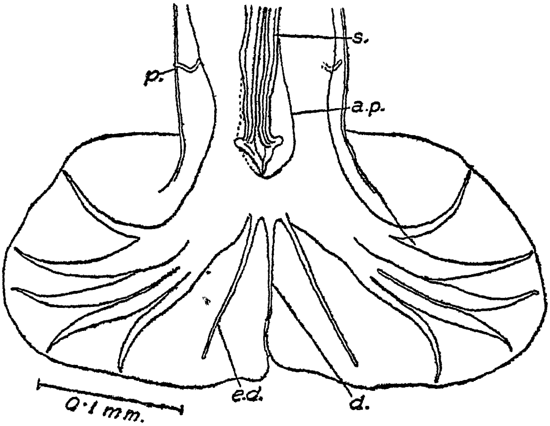


Fig. 13.



Nicollia tachyglossi, gen. et sp. n.

Fig. 12.—Anterior end of female; lateral view. *b.c.*, buccal capsule; *c.i.*, cuticular inflation; *n.r.*, nerve-ring; *t.*, dorsal tooth.

Fig. 13.—Posterior end of male; dorsal view, with bursa spread out. *a.p.*, accessory piece; *d.*, dorsal ray; *e.d.*, externo-dorsal ray; *p.*, prebursal papilla; *s.*, spicules.

into two fine branches. Externally to these, and parallel to them, are two accessory branches which originate immediately above the point of bifurcation and are of approximately the same length. The externo-dorsal rays are

Fig. 14.

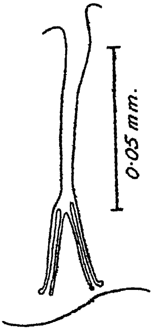


Fig. 15.

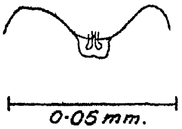


Fig. 16.

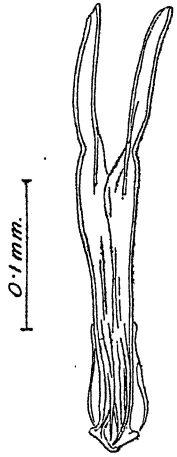
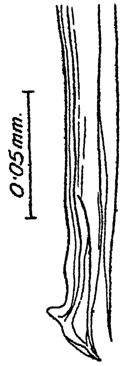


Fig. 17.

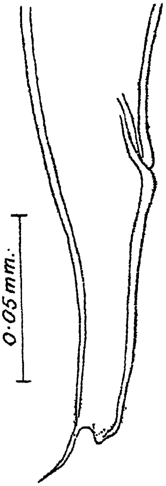


Nicollia tachyglossi, gen. et sp. n.

Fig. 14.—Dorsal ray of male.
Fig. 15.—Genital cone of male; ventral view.
Fig. 16.—Spicules and accessory piece; ventral view.
Fig. 17.—Tip of right spicule; ventral view.

slender and originate independently of the dorsal ray. The lateral and ventral rays arise from a common trunk. The postero-lateral ray is rather more slender than the other lateral rays, and diverges from them. The medio-lateral and antero-lateral rays are divergent at their tips. The ventro-ventral ray is considerably more slender than the latero-ventral, and diverges rather widely from it. A pair of prebursal papillæ is present. There is a small genital cone (fig. 15) bearing a pair of stalked papilla-like structures. The spicules (figs. 16 and 17) are 0·3–0·32 mm. long. In their proximal third they are tubular, while the distal two-thirds are expanded, somewhat membranous and flattened, and closely applied to each other. The tip of each spicule is of somewhat complex structure, having one termination barbed and resembling in profile the outline of the lateral view of a human foot, and apparently two sharply-pointed terminations. There is a membranous accessory piece, forming a guide for the spicules.

Fig. 18.



Nicollia tachyglossi, gen. et sp. n.
Posterior end of female; lateral view.

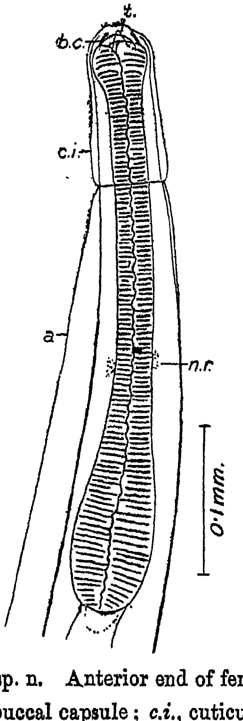
The tail of the female (fig. 18) is about 0·08–0·1 mm. long, and bears dorsally at its tip a slender terminal spike, while subventrally there is a pair of short blunt processes. The vulva is situated at 0·55–0·7 mm. from the posterior end, and is not prominent. The female genital tubes are opposed, and there is a pair of ovejectors whose combined length, including the sphincters, is 0·22–0·26 mm. The eggs have thin shells measuring 0·067–0·08 mm. × 0·37–0·045 mm. Their contents are undergoing segmentation at the time of laying.

4. *Nicollia echidnæ*, sp. n. (Figs. 19–23.)

This species, which was collected on three occasions (by Dr. W. Nicoll, Mr. J. W. Fielding, and Mr. F. H. Taylor) from the intestine of *Tachyglossus aculeatus*, is very similar to that just described, but is a somewhat larger form and differs from it morphologically in a number of characters.

The male is 5–6·4 mm. long, the female 6·4–6·8 mm. In both sexes there is a wide lateral ala (fig. 19, *a.*) on the left side only. This begins immediately behind the cephalic cuticular inflation (at a point 0·09–0·12 mm. from the anterior extremity), and extends as far as the bursa in the male, and as far as the vulvar region in the female. The maximum width of the male (including the ala) is 0·15–0·17 mm. The maximum thickness of the female (at the vulva) is 0·16–0·19 mm. The cuticle of the body has excessively fine transverse striations (much finer than in *N. tachyglossi*)

Fig. 19.



Nicollia echidnæ, sp. n. Anterior end of female; dorsal view.
a., ala; *b.c.*, buccal capsule; *c.i.*, cuticular inflation; *n.r.*, nerve-ring; *t.*, dorsal tooth.

and also numerous longitudinal striations. These, however, are not raised into prominent crests.

There is a shallow buccal capsule (deeper, however, than in *N. tachyglossi*) and a similar protrusible dorsal tooth.

Fig. 20.

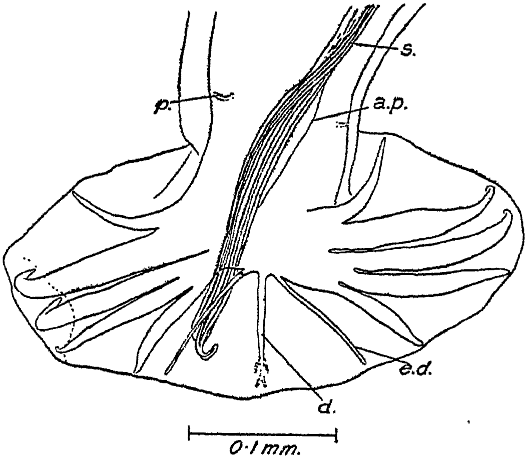
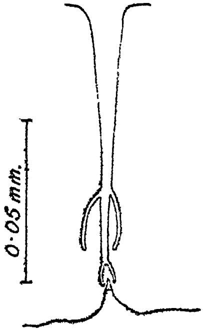


Fig. 21.



Nicollia echidnæ, sp. n.

Fig. 20.—Bursa of male, spread out; dorsal view. *a.p.*, accessory piece; *d.*, dorsal ray; *e.d.*, externo-dorsal ray; *p.*, prebursal papilla; *s.*, spicules.
Fig. 21.—Dorsal ray of male.

The œsophagus is of the same shape as in that species, and the nerve-ring is situated behind its middle. The œsophagus is 0·32–0·4 mm. long in the male and 0·42–0·5 mm. in the female.

The characters of the bursa of the male (fig. 20) are almost exactly similar to those already described for *N. tachyglossi*, except in the form of the dorsal ray. In the present species this ray (fig. 15) bifurcates only quite close to its tip, and the accessory branches originate at some distance from the bifurcation and are relatively short. The spicules (fig. 20, *s.*, and fig. 22) measure 0·42–0·45 mm. in length. They are similar in general form to those of *N. tachyglossi*, but relatively more slender, and their tips are hooked dorsally.

Fig. 22.

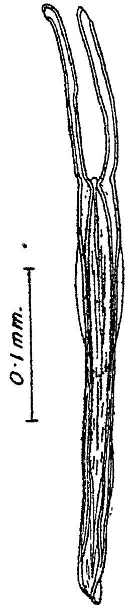
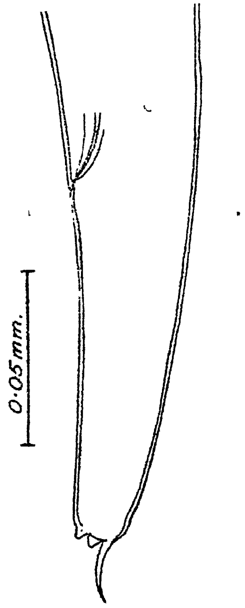


Fig. 23.



Nicollia echidnæ, sp. n.

Fig. 22.—Spicules and accessory piece; dorsal view.
Fig. 23.—Posterior end of female; lateral view.

The tail of the female (fig. 23) is 0·12–0·14 mm. long, and shows the same structure as in *N. tachyglossi.* The vulva is situated at 1·2–1·4 mm. from the posterior end. The combined length of the ovejectors, including the sphincters, is 0·26–0·31 mm. The eggs measure 0·055–0·075 mm. × 0·03–0·033 mm., and their contents are segmenting when ready for laying.

The two species described above possess a combination of characters which seems to necessitate the erection of a new genus. This may be briefly defined as follows :—

NICOLLIA, gen. nov.

Trichostrongylinæ: body with longitudinal crests and sometimes with a lateral ala on the left side. Cuticle of head slightly inflated. A shallow buccal capsule present, containing a large protrusible dorsal tooth. Bursa with symmetrical lateral lobes and without a distinct dorsal lobe. Ventro-ventral and latero-ventral rays widely divergent, the former more slender than the latter. Medio-lateral and postero-lateral rays also rather widely divergent, the latter being more slender than the former. Externo-dorsal rays originate independently of the dorsal ray, near its base. Dorsal ray bifurcate at its tip and with a pair of accessory branches. Prebursal papillæ present. Spicules simple proximally, somewhat membranous and divided distally, with one of the terminations barbed or hooked. An accessory piece present. Tail of female with a dorsal terminal spike and two short subventral terminal processes. Vulva towards posterior end of body. Eggs segmenting when deposited.

Genotype.—*N. tachyglossi*, sp. n.

Other species.—*N. echidnæ*, sp. n.

Hab.—Intestine of Echidna (*Tachyglossus aculeatus*).

The two species here assigned to the genus *Nicollia* approach, in some respects, rather closely to the form described by Chandler (1924) under the name of *Austrostrongylus macropodis*, from *Macropus bennetti*. In *Austrostrongylus* there is a fairly deep buccal capsule containing a large dorsal tooth and a smaller ventral tooth. The arrangement of the bursal rays is very similar to that found in the present two species, but the lateral lobes of the bursa are markedly asymmetrical, the right lobe being much larger than the left. The tail of the female is said to taper to a fine point, and is apparently simple and without the terminal processes described above.

Another form which seems to be rather closely related to *Nicollia* is *Bradypostrongylus panamensis*, Price, 1928, from the three-toed sloth in Central America. In this worm, again, the lateral lobes of the bursa appear from Price's figure (1928, pl. i. fig. 2) to be somewhat asymmetrical, and the dorsal ray and the spicules, with their accessory organs, show considerable differences from *Nicollia.* The tail of the female is very much like that of *Anoplostrongylus,* having a terminal filament and three conical processes.

The genus *Nicollia* is named in honour of Dr. W. Nicoll, who has done much valuable work in the field of helminthology generally, and of Australian helminthology in particular. It seems somewhat doubtful whether the "little red worm" referred to by Dr. Nicoll (1914) as occurring not infrequently in the intestine of the Echidna was identical with either of the species here described. It is stated to retain a coiled shape when treated with hot alcohol, whereas most of the present specimens do not show any coiling, in spite of the asymmetrical lateral ala in one of the species.

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II.—*Some Responses of Sockeye Salmon to Environmental Influence during Fresh-water Migration.* By Professor HENRY B. WARD, University of Illinois, Urbana, Illinois *.

EVER since the first contact of man with the salmon of the Pacific coast the nature of these fish has been surrounded with mysteries which grew, naturally, out of their remarkable migrations. Hatched in the gravel of some lake or stream near the head-waters of a river-system, the young fish start often at a very early age to wander towards the sea, and, reaching it, plunge into its unknown depths, carrying out somewhere the activities associated with life and growth. They come back full-grown, seeking an entrance to fresh water, and start the upstream migration with a determination that brooks no restraint. After having overcome every obstacle in their way which it was physically possible to surmount, they reach the spawning-grounds, where the final event of their life-cycle is fulfilled, and the history of the individual is ended.

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* 'Contributions from the Zoological Laboratory of the University of Illinois,' No. 372.

The human mind is always striving to find some explanation for conditions which exist, and it is only natural that in so interesting a history as this there have grown up around the different parts of the story theories which have claimed to explain the actions of the fish. Often these have been based upon the interpretations of the events from the human standpoint, and in other cases the observer has invested the events with a mystical character which calls forth the exercise of powers unknown to man. Even the most plausible of such interpretations has been based upon evidence that was scanty and perhaps easily capable of a different interpretation. The whole discussion displays a minimum of actual knowledge and the maximum of opinion that gives to the structure the character of a card-house, likely to be overthrown at any time by even a gentle breeze of facts.

For the proper handling of protective devices, for the drafting of protective legislation, and for the reasonable enforcement of control measures it is essential in some way or other that a more extensive and accurate knowledge of the characteristics and habits of these fish be secured. While in one way much scientific study has been devoted to the Pacific salmon, this has centred about the names, structure, distribution, and relationships of the various types, and little accurate information has been gained concerning the relations in which the salmon stands to the various factors in its environment, the methods by which it discharges its various bodily functions, and the influences which determine its actions under different circumstances or at different periods during its life. It is easy, of course, to interpret its activities from the human standpoint, and the explanations many have given for various occurrences are closely akin to those which might be made if men were to act in somewhat similar fashion under such conditions. Nothing could be more unfortunate than the attempt to interpret the actions manifested in such fashion. Whatever may be true concerning the activities of the salmon, abundant evidence is available to demonstrate that the fish do not and cannot perform their functions in the same way or in response to the same stimuli as man. It would take too long to recount all the evidence that could be marshalled in support of this view. One or two of the outstanding features of the case may be pointed out.

In the first place, the role of the salmon is played in an environment so radically different from that of which we have personal knowledge that it is difficult, even impossible, to figure to ourselves how things would influence us under those conditions. We are accustomed to environmental influences that certainly are fundamentally modified when they come to bear upon the fish. Indeed, there is hardly any way in which the senses of the fish could be affected in its aquatic environment as are the somewhat similar sense-organs of the animal that lives in the air. Temperature, pressure, light, sound, current, and other factors act upon the fish in a way that is, at least, strongly at variance with the same influences under atmospheric conditions.

In the second place, the careful study of the anatomist has shown that there are conspicuous differences in machinery; that in the fish the balance of organs is not the same as that in higher land-living vertebrates. This difference in machinery can surely not be reasonably explained on any other basis than some difference in the operation of the machinery, or in the processes by which the salmon receives its information from the outer world and responds to such stimuli. Most striking of all these differences, and perhaps most significant for this argument, is the contrast between the development of the great central nerve-organ, the brain, in fishes and in higher vertebrates. Associated with this are conspicuous differences in the degree of development, and hence in the relative importance of the special sense-organs, which are, of course, the sources through which the animal acquires its information of things within and without itself.

If we are to find a legitimate understanding of the life that a fish leads we must make such a study of its activities under natural conditions as will enable us to say how these conditions must be modified for the purposes we have in view. Such studies have only infrequently been made. Parker (1913, 1918) has carried out an extensive and valuable series of observations and experiments on the sense of hearing in fishes. Reighard (1917) has discussed the problem of sight in fishes, and has contrasted the situation with that which exists among air-living animals. Shelford (1914) has experimented with the reactions of fishes under the influence of certain stimuli, and numerous other contributions have been made by various authors, but all of these together give at best an imperfect picture of the conditions among fishes in general. Our knowledge of fish psychology is exceedingly scanty, and even at that the material gained by these investigations cannot be used without great care in the study of the Pacific salmon, for each type of fish is more or less individualistic, and apparently no work has been done to determine the accuracy of these general observations when applied to the particular species which is under consideration here.

Elsewhere I have called attention (Ward, 1921) to the fact that much confusion has entered into our conception of the salmon problem, because the observations made on different species of Pacific salmon have been lumped together without regard to the particular kind of salmon on which the observations were made. In studying these forms one might reasonably conclude that different species of salmon would act more like each other than would a salmon and a shark; but one need not be surprised, and, indeed, might expect, to find between different species dissimilarities like those between lions, tigers, and wild cats. All recognize, indeed, some such differences between different kinds of Pacific salmon with reference to the distribution, the feeding habits, and the spawning habits, and one must be prepared to find similar differences in other fields of activity. All of these considerations are preliminary to the discussion of our actual knowledge concerning the responses of the salmon to environmental influences; and that the discussion may be more precise as well as less complex I have chosen to limit this paper to the responses to environmental stimuli which are manifested by the sockeye salmon during that concluding period of adult life which is known as the fresh-water migration. In other words, the sockeye is taken at the time that it had entered fresh water, and is followed during the brief period between that moment and the end of its existence.

RESPONSE TO CURRENT STIMULUS.

Anyone who observes these fish at all carefully sees that the sockeye is influenced by the physical and chemical features of its environment, and responds to these influences differently at different times in its life-cycle. Unfortunately the fish have not been sufficiently continuously observed to determine all their activities under different circumstances. Greater attention should be given to this and more precise and continuous observations made with a view to determining reactions of the fish, not only under the general conditions, but under the special circumstances which bring about often some modifications of the general behaviour or show to what extent a given activity is a general response or special.

The most generally recognized response of the sockeye to environmental stimulus is the reaction to the current of the stream. It is well known that young salmon tend to drift downstream until after a period of time, varying in different species, they pass out into the ocean. The adult, on entering fresh water, manifests the opposite tendency, and strives constantly upward. That this is a response to the current stimulus is evidenced by their action at the mouth of the stream where the influence of the tidal current causes them to turn and move backward when the flow changes (Rutter, 1902). Since the outflow is stronger and longer than the inflow, the salmon ultimately passes upstream beyond the influence of the tides, and thereafter continues to progress upward through the stream until a spawning-ground is reached. This upward movement is continued through lakes which may intervene in the course of the river, even though the current in such cases may be so greatly reduced that its velocity is hardly perceptible and even impossible to measure by ordinary apparatus. This I have observed in several Alaska streams where lakes occurred in the course of a river. However, no evidence has been secured as to the depth and temperature of such lakes, and deep cold lakes may terminate the upstream movement even though shallow lakes may not even delay the progress of the salmon. Many experiments have been tried to persuade the salmon to retrace their steps and move downstream, but none of those with which I am familiar have been successful in accomplishing that end. However, there is on record one case of a sockeye which, after being tagged, left the stream and was ultimately caught in another river some distance away.

I have also observed instances of reverse movement in a stream under special conditions. At a power-dam on the Baker River a fish-rack normally prevents the passage of the fish upstream from the rack near the power-house to the foot of the dam several hundred feet beyond. On one occasion, by an extra flow of water over the dam, a hole was washed out in the gravel at one point under the rack and a large number of fish went through it and were marooned in the stretch of the stream between that point and the dam. They went through this and up the stream at night, when one of the gates in the dam was wide open and a considerable flow of water was coming down through the rack. When the gate was closed, and the water above the rack began to fall rapidly, we watched the fish, and observed from their restlessness that they were aware of changing conditions. One could see how, in small groups, they manifested marked nervousness and activity. Instead of moving more or less regularly upstream the groups began to circle around in the deeper portions of the stream and suddenly to dart downstream for considerable distances, swinging around in short circles as they reached a slightly deeper pool. There they faced upstream, and hung for a few moments in the current, only to repeat the process shortly as the water continued to fall. By such downstream dashes they ultimately reached the rack, and, while sometimes certain groups would attempt to swing upstream again, ultimately all of the good healthy fish darted downstream through the hole under the rack and into the deeper portion of the river below. After an hour one could find above the rack only a few sluggish badly fungused fish, which had not participated at all in the movements described, but contented themselves with maintaining their position quietly in deeper pools, not striving to ascend the stream or to retrace their path and escape to the deeper waters below the rack. These were probably the same fish that had been seen above the rack on previous days, and, while some of the good fish which had gone through the hole were concealed in the deep pool at the foot of the dam, so far as one could see, the entire stretch of the stream above the rack had been emptied of the fresh active sockeyes.

The response of the sockeye to the current stimulus is apparently not the same under artificial conditions as it is in natural waters. Thus, at the Baker River dam fish sometimes approached the mouth of the trap at the foot of the fish-ladder, and, despite the current issuing from the opening, passed by, or even in some cases, after having started to enter the opening, withdrew and swam away. The reason for this action is not clear, although a plausible explanation is discussed at another point in this paper. Sockeyes, when caught in pools or pockets of the ladder, in the majority of cases studied, made no effort to work their way up, and only a small fraction of the run persisted in attempting to reach the higher pockets until they had surmounted the ladder fully. Some of them merely hung in the water, or, in the case of deep dark pools, went to the bottom and stayed there without making any effort to advance. Others nosed along the sides of the pool, even stretching above the surface of the water in an apparent attempt to test in some way the character of the barrier, while, at the same time, they neglected the current which was pouring into this pocket at one end; indeed, they often seemed to seek most vigorously for an outlet at the opposite end of the pocket. Furthermore, many of them were not content with nosing around the wall, but sought to jump at the sides and away from the inlet to the pocket. This was particularly true when an effort was made to force them to continue upstream. With that end in view a screen was put in at the lower end of a long flume-pocket and moved gradually towards the upper end. Under such circumstances they all fought violently at the screen and refused to be forced into attempting to enter the pocket above, from which a considerable stream was flowing into the lower pocket at the end opposite the screen. This manœuvre may, of course, have been conditioned by the rapid flow of water forced past the screen, although, in some cases at least, the movement of the screen was so slow that, to our eyes, the current was much less powerful than the inflow at the opposite end of the pocket.

The failure of the sockeyes to attempt the passage from one pocket to another did not depend upon the depth of the pool, for the tendencies already noted to hang back and to test the sides and other parts of the pocket where there was no inflow was manifested equally strongly whether the pools were deep and dark or shallow and more exposed to the light. The action of the salmon was not modified greatly by changing the character of the inflow, although, when the height of the drop from one pocket to another was reduced and the sockeyes had the opportunity to shoot upward through a solid stream of water, the results were better than when the distance was greater and the water fell as a small cascade from one pool to the other so that the fish were forced to make the passage by jumping. A few such jumps seemed to exhaust the energy or the desire of the fish to proceed upstream. This may have been due to the fact that the sockeyes had been exhausted by experiences previous to entering the ladder. This phase of the situation deserves attention separately, and will be discussed later.

The sockeye responds rather precisely to the direction of the flow, and first of all let me say in passing that herein is found one of the chief reasons why many fishways are not successful. Located as some fishways are far to one side of the barrier, and with a weak stream issuing from the entrance, they fail to attract the attention of the fish; the salmon continue to fight the main current even though no ascent is possible there. An interesting and successful means of bringing the migrating salmon to the desired place was introduced at the Baker River dam. The stream is barred by a rack placed directly across it at the upstream end of the power-house. The fish-ladder starts at the corner of the power-house, and to draw the fish into that angle the rack-bars are set obliquely, with the result that below the rack the current appears to flow across the true channel and to come from the corner where the trap is located. This device, which is successful in drawing the fish to the entrance of the trap, was worked out by Mr. A. P. Newberry, manager of the power-plant, and because of its evident value deserves to be widely known. It is fitting to acknowledge here my indebtedness to Mr. Newberry for material assistance rendered in many ways during the course of my studies on the Baker River, and especially for numerous valuable suggestions during the discussion of the problem, which were carried on almost continually while I was working at Concrete during the summers of 1927 and 1928.

RESPONSE TO TEMPERATURE STIMULUS.

The second environmental stimulus which definitely influences the movements of the sockeye is the temperature of the water. It has long been believed that the members of the trout and salmon family like cold water. Their distribution is limited to that portion of the northern hemisphere where they find cold water. They occur in colder streams, and disappear when changing conditions cause the water to rise into temperature levels higher than 60° or 70° F.; the anadromous species move into streams which are characterized by cool water. But the temperature of the stream is not the only element involved in this choice, for there are cold-water streams which are not utilized by the anadromous species, and, furthermore, so far as the older reports are concerned, the fish were merely spoken of as enjoying a cool aquatic environment. No precise evidence was available on this relation until a few years ago. I published certain studies (Ward, 1922) to show that the temperature of the water is not only a general condition of existence, favourable if below a certain level and unfavourable above that, but also that the temperature is a directive stimulus influencing the course of migration and the selection of the spawning-beds of the sockeye salmon.

In that study I showed that when the sockeye was confronted at a junction-point with the necessity of making a choice between one of two streams it was guided first of all by the temperature of the water, selecting in every case studied the cooler stream, unless the situation was complicated by other relations, of which more later. To the large number of cases which I had studied before making that announcement the numerous intervening years have added other similar instances. There seems to be little doubt that under ordinary circumstances the sockeye selects inerrantly the cooler stream. The first demonstration of this relation was obtained when I made my earlier studies of the migration of the sockeye which ascend the Skagit River. This is a considerable stream emptying into the Puget Sound close to Anacortes, and carrying a fine run of sockeyes. This run has been long regarded as of great value in the State of Washington, and was sufficiently important to lead years ago to the establishment by the U.S. Bureau of Fisheries of a hatchery on the lake where these fish spawned.

The fish entering the Skagit proceed upstream as far as Concrete, where the Baker River empties into the Skagit. Despite the fact that the upper portion of the Skagit is an extensive river-system, with places that are apparently well suited for the spawning of the sockeye, all of these salmon turn aside from the main stream and go up the Baker River some twenty miles to Baker Lake, where they ripen, and on the banks of which they spawn.

Careful and extensive study of the conditions at their junction disclosed the fact that apparently the only difference between the two streams was that of temperature. The Baker River is regularly one or two, or rarely more, degrees colder than the Skagit above the junction. Although the tributary joined the larger stream with a re-entrant angle, yet the sockeyes all made the turn and went up the Baker River. Similar instances are cited in the paper mentioned to show that when the sockeye in other rivers arrives at a stream-junction where it is called upon to make a choice, that choice depends primarily upon the temperature of the water, and the fish selects the cooler stream regardless of most, if not all, other conditions.

Recently a power-dam was built in a canyon on the Baker River a mile or more above the junction with the Skagit. This interposed an insurmountable obstacle to the migration of the fish to their spawning-grounds, and has been the seat of extensive experiments to provide the sockeye, and other salmon also, with means for surmounting this obstacle, and thus being able to continue their journey to the spawning-grounds.

In a paper read last year before the National Academy of Sciences I pointed out in detail (Ward, 1927) the way in which the installation of the dam and the formation of a large impounding reservoir modify natural conditions, and thus affect the migration of the salmon. The changes induced may be stated briefly. In the first place the water passed through the power-plant is taken from a low level in the lake and constitutes from two-thirds to the entire volume of the river below the plant. In consequence the temperature of the Baker River at the junction is lower than previous to the construction of the power-plant, and the difference in temperature between it and the Skagit is accentuated. Now, as before, all the red salmon turn into the Baker. Were the plant to be entirely shut down by some exigency when the reservoir was so full that water rose over the level of the gates, then, in the late summer time at least, the water discharged into the river would certainly be warmer than that of the Skagit, and the conditions established would reverse the natural relations between the two streams. Under these conditions it would be interesting to observe the movements of the sockeye, for if they were influenced primarily by the temperature stimulus they would proceed up the Skagit, following a route not taken within times of which there is any record; even the natives in this territory assert most definitely that in all the past of which they have knowledge the sockeyes have always gone up the Baker. A similar interesting change in the character of the stream has actually been realized at one point in the course of the Baker River, and will be discussed later.

Effects of Tail-Race.

Second, as the sockeyes approach the power-house they are confronted by a new choice which results from the installation of the power-plant. The old bed of the river carries only a little water unless the reservoir, Lake Shannon, is overfull and some water is being spilled through the gates. The major part of the stream is discharged through the tail-race from the side. This water is not only greater in volume, but regularly considerably lower in temperature than that which comes down the old channel from the dam. The condition of the water in the tail-race was so disturbed that one could not possibly determine whether the salmon entered it immediately on arrival; but continued observation showed that a good many sockeyes were in it fighting the current, also that they kept themselves away from the surface, and thus escaped notice, except when, carried upward by the boiling of the discharge, they came into sight for a moment only, to make a spurt immediately downward and disappear in the bottom waters. Apparently they remained there fighting the current until, worn out, they were compelled to retire and rest in an eddy just outside the concrete pit into which the water was discharged from the turbines. Rarely one could see them, apparently exhausted after fighting the current, being carried out, or, in one instance, swimming definitely and intentionally out from the concrete basin. The old channel of the river extended parallel to the power-house, and, at the upstream corner of the house, was barred by a rack extending across at right angles to the stream-bed. Fish appeared both in the eddy formed where the water flowed down the old channel and met the water from the tail-race and also along the underside of the rack. At the power-house end of the rack was located a trap to catch the salmon, and from this they were lifted in one way or another by experimental installations and put over the dam into Lake Shannon. The sockeyes which were caught in this trap were largely in poor condition, and did not present the appearance of fresh, active, migrating adults. In addition to natural marks, the fish showed extensive abrasions, injuring seriously the skin of the head and of the sides, especially on the left near the tail. These might have been acquired in the tail-race fighting the strong current. The injuries were, in most cases, the seat of fungus disease which had become so advanced that the fish certainly must have been fighting obstacles of a serious character, and must have been injured some days before to put them now in such poor condition physically, and their apparent lack of energy supported this view. Yet this is the first point at which any obstacle confronts them in their journey from the ocean, and no obstacle is to be seen except that afforded by the tail-race and the turbines.

One will naturally ask why, if the salmon are attracted by water of lower temperature, they should pass by or even desert the tail-race with its cold water and appear in the warmer water at the rack, or, in any case, pass beyond the junction of the tail-race with the stream. It is, perhaps, reasonable to assume that, having spent much energy in the vain attempt to make their way upward in the tail-race, they should drop back when exhausted and endeavour to seek a way which, though not selected preferably, might still offer a possibility of getting on to the spawning-grounds. The trap at the rack was supplied at different times with water of varying temperature by taking some from the tunnel through which came the supply that later reached the tail-race. The result was not conclusive, although on the whole the colder water seemed to attract the fish better than when the trap was supplied with warmer water. It seemed at times as if water of intermediate temperature was more successful than an exclusive supply of cold water; but the fish, which were clearly lacking in energy and, for the most part, seriously affected by injuries and by fungus disease, or at least the large majority of them, did not have energy enough to force their way through the ladder previously mentioned, and consequently hung around at one point or another, resting and becoming more heavily fungused until they died or were dipped out. Safe conclusions could hardly be drawn under these circumstances regarding the normal activities of the migrating sockeye.

OTHER TEMPERATURE INFLUENCES.

The temperature conditions were very highly modified in that section of the former river which, by the erection of the dam, had been made into a reservoir. This section, some 8 miles long, was over 200 feet deep at the dam, and had a very considerable area of deep water. Temperature tests showed that under the influence of the summer sun the surface-waters had warmed up to 70° F., which is a much higher temperature than the waters of Baker River ever reached. On the other hand, the temperature at 40 feet in depth was 53° F., or that of the Baker River at the head of the lake, and the temperature at the bottom was only a little above 40° F. Of the fish put over the dam only about one-third reached Baker Lake and the natural spawning-grounds, It proved impossible to trace the fate of all the missing fish. It seems altogether likely that some of them got down into the colder waters at the bottom of Lake Shannon, and were trapped there, so that they rested and ripened without continuing their journey upstream. In that case those fish probably sought, at the spawning-time, points somewhere along the shore of the lake where they found conditions for spawning, and this record of their final activities escaped notice because of the extent of the area and the lack of study of that area at the appropriate time. Only those fish which did not go down below the normal temperature zone of the river would then have been led to continue upstream, and, if physically able, would have reached Baker Lake. That those fish which did start on their journey up the Baker River might be diverted by special circumstances was well illustrated by one situation, which should be recounted in detail.

At the mouth of the canyon where the upper Baker River emptied into the head of Lake Shannon the stream is joined by Sulphur Creek. Under early conditions the waters of this stream were characterized by an unpleasant quality which justified the name, but the entire volume of the stream had later been diverted for power-purposes some 2 miles above the mouth, and the present flow of Sulphur Creek comes exclusively from a number of large springs which flow out of the side of the hill only half a mile from the mouth of the creek. These emerge above an impermeable stratum, and furnish clear sparkling water of low temperature. As the course of the stream is short and well protected by heavy timber-growth the water it still cold where it empties into the Baker, having a temperature of 42°·5 to 44° F. under different circumstances. In deep pools at the mouth of the creek were found salmon that had been drawn into it, and either were resting and waiting the period of maturity or were endeavouring to make their way up this small stream. The water was admirably adapted to attract the fish, and though its volume was so small in comparison with the Baker River that the influence could hardly be felt except with those fish which came up the corresponding bank of the river, yet the fraction of the run which did come under the influence was evidently captured by this stream, whereas under former circumstances the quality of the water would have repelled them. My studies on the river some years ago showed that the salmon passed by this point without stopping.

Only one other stream of any size comes into Lake Shannon. This is known as Thunder Creek, and was said to have been visited last fall by spawning-salmon. During July and early August of 1928 there was no trace of salmon in it, and the water was warmer than the water of the Baker River, and yet, from a study of the source of Thunder Creek, it appeared possible that the temperature of the creek would vary in different seasons, and thus, under some circumstances, might attract salmon seeking a spawning-ground. All the other streams emptying into Lake Shannon directly are small and probably warmer than the lake, although there are many natural springs emptying into the lake at various points and depths, which would furnish a supply of cold water to attract individual salmon and furnish spawning-grounds for small numbers. These springs, which were formerly above the water-level of the river, are now submerged, and cannot be seen or their influence determined. The extent of the lake and the present conditions of the shores are such as to make a complete survey exceedingly difficult.

All the fish which go up the Baker River into Baker Lake are caught by a trap at the outlet of the lake, and, instead of being permitted to drop into deep water and ripen there, are carried to the head of the lake and ripened in a pen. This pen is located close to the natural spawning-grounds, and those again, since they are spring-fed, offer the coldest and freshest water that can be found in the shallows along the shores of the lake. Here, as elsewhere, in seeking spawning-grounds, the salmon select the shore-water in which, by virtue of ground-water seepage, they find the low temperature and high quality which makes the situation most favourable for the preservation of the eggs (Ward, 1922).

INFLUENCE OF CHANGING CONDITIONS.

In view of the definite responses of the sockeye to temperature variations in the water, it is important to consider the extent to which the activities of this fish may be modified under changing conditions in the environment. Under natural conditions the temperature relations in any river basin remain reasonably constant, and the path of migrating sockeye being determined by temperature primarily will also be constant; further, it will evidently be of such character that, viewed on the map and without knowledge of stream conditions, it will appear to be erratic. The temperature relations in different streams in the system will depend upon the source of their flow. If the waters are derived from springs or from ice- and snow-fields they will be lower in temperature than those of the stream which acquires its flow from the run off or from a general seepage of ground-water. Furthermore, the exposure as well as the rapidity of the flow will be instrumental in governing temperature conditions, for the waters that come from the deep forest are naturally colder than those which flow in an open valley exposed to the sun, and streams of rapid movement hold their low temperature better than those which are sluggish. These conditions give a clue to the determination of the route followed by the salmon, and show why this route is so definitely fixed in most cases.

However, it must be recognized that as the season advances temperature conditions in certain streams become modified; the snow-fields disappear, the volume of the stream becomes reduced, its flow is less rapid, the period of insolation is longer, and a longer channel affords opportunity for the water to become heated up. Thus there may follow a period of relative stability, or one in which temperatures are variable, and it is even possible that the relative temperatures may be modified with the alternation of clear and cloudy weather or periods of lower and higher atmospheric temperature. Such conditions lay the foundation for modifications of the conditions that existed at an earlier date, and may be the source of variations in the movements of different runs of salmon, thus affording a definite explanation for what, as recorded, seems to be distinctly erratic. Furthermore, when the temperature of two confluent streams becomes approximately equal and is subject to slight fluctuations due to such conditions as have been just indicated, then one or the other possible lines of movement becomes variably a little higher or lower in temperature, and thus more or less attractive to the migrating salmon. The movements of the fish will then become uncertain or variable. In this connection it must be borne in mind constantly that the fish are sensitive to temperature variations (Shelford and Powers, 1915) which, to the human organisms, are trivial and not appreciable; and because of it a shift in the run may be definite, and even though, from the human standpoint, apparently inexplicable, yet in fact capable of explanation by exact temperature determinations of the water.

In the case of the sockeye it is well known that the adults pursue their migration upstream until they have reached a lake in which they go into deep water and lie there until they are ripe and ready for spawning. In the course of this migration they sometimes pass through lakes that are intermediate in the course of a stream. In cases of this sort, which I have studied personally, the intermediate lakes are small in area, and consequently the current stimulus of the stream is undoubtedly appreciable in the lake. Temperature studies have not yet been made on such lakes, and I have no data on the depth or bottom conditions of those which I have seen. The erection of the power-dam on the Baker River has inserted into the course of the stream a lake which is both large and deep, and the consequent modification of conditions in the river-system is extreme. The large volume of this reservoir, named Lake Shannon, substantially eliminates all current stimuli. The movement of the water is so slight that it cannot be measured by any apparatus with which I am familiar. This would seem to eliminate the possibility of any influence derived from this source affecting or influencing the migrating salmon. In the next place the temperature at the bottom of the lake in the deepest area near the dam is only about one degree higher than the temperature of maximum density of water. Consequently, it will vary very little through the year. More than that, it is about six degrees lower than the temperature at the bottom of Baker Lake, which, under former natural conditions, was the point in which the salmon stopped and ripened. Now, if the salmon that are put over the dam are left to go down deep into the lake, seeking the coldest water available at this point, it is difficult to see what would lead them to leave that area until they became ripe and were impelled to seek for some spawning-ground.

No evidence is available to show whether the temperature stimulus is unlimited in effect or whether the urge of colder water is limited by a small temperature difference between that which the fish have been subject to during the previous period in the migration. It is possible that there may be an absolute limit, and that the salmon are attracted by a temperature somewhat lower than that of the water in which they have been swimming, but that an extreme difference of temperature does not attract them or that temperature below some set limit, as yet unknown, repels rather than attracts. The migrating sockeyes, on being discharged into Lake Shannon, desert the surface at once and start downward into levels where they can no longer be seen and followed. That at this season they should promptly desert the surface with its high temperature of 68° to 70° F. is understandable. No evidence whatever is available to show how far down they go. If they have a natural preference for the temperature of the Baker River below the dam, and, having found that, continue to move at that level up through the lake, then they will ultimately come under the current influence of the Baker River and continue their migration to Baker Lake. If, on the other hand, they persevere in a downward movement through successive layers of progressively cooler water, they will get into regions much colder than the water of Baker River. In this case no factor can be seen which will force them to move out of the colder water and into warmer strata; but this is not the only factor involved in holding them. The water of the Baker River, at a temperature of 53° F., is consequently warmer than the deep waters of Lake Shannon. In flowing into the lake it would move through a stratum that is about 45 ft. below the surface, and thus more than 150 ft. above the coolest water at the bottom of the lake. The deep areas of cold water would lie well below any current influence, and constitute thus apparently a physiological trap, from which the fish would not be stimulated to escape by any influence of which evidence has been secured until the completed development of the sex-cells contributes an urge to seek spawning-grounds and discharge the reproductive function. It is, of course, clear that with these, as with other organisms, the urge to discharge that function will outweigh other stimuli, and release the complex of reactions which will lead the fish to find some place for discharging the sex-cells. Such a place will be characterized by appropriate conditions provided it can be secured, but if it is not available some other place must be taken which offers the possibility of discharging the function, even though the conditions are not suitable for the subsequent development of the eggs.

ORIGIN OF LAND-LOCKED VARIETY.

It is appropriate here to inquire regarding the influence which these changes in the stream exercise on the migrators or young fish going down to the ocean. As is well known, the young sockeyes remain in the lake in which they were hatched for some months, and in the spring following they start downstream, reaching the ocean early in the second summer. This migration is carried out in the Baker River during early spring months, when I have not been able to observe the movements myself, but the reports from various careful observers are sufficiently definite to show that the fish come down into the artificial reservoir, and are seen in large numbers playing along the shores of that body of water, and accumulating near the dam. This occurs in the season when no water is being wasted through the gates. When, however, they have accumulated in considerable numbers at the gates, these are opened, and they go out with the current. No accurate observations have been made as to the real success of this method of transporting the migrators from the lake-level into the stream below. It deserves, of course, careful study, but until that is made discussion of the problem is unwise.

I pointed out previously the likelihood that the formation of the artificial lake, which introduced a new feature in the normal path of migration, might bring about changes in the movement of the sockeyes, even to the extent of preventing them from proceeding further. It is evident that the young fish, having entered a large body of quiet water, are relieved from the current stimulus under the influence of which they have been previously acting. Playing along the shore of this quiet water it seems as if they might easily lose the impulse under which they had been acting and follow that which under normal conditions next succeeds the tendency to move downstream. Under natural conditions the downstream movement would continue until they reach the ocean, and then, after an indefinite period, the sockeye goes into deep water. In Lake Shannon the first of the migrators which come down from the river play along the shores for a considerable time before they have opportunity to proceed downstream. They find no current moving out of the lake from the surface region. As the spring advances the lake water naturally warms at the surface, and some at least of the migrators are impelled to go down. Once engulfed in the dark cool depths of the lake they are physiologically imprisoned, and will be acted upon by no environmental condition which will impel them to move further. They will remain in this region until with growth the development of the reproductive impulse influences them to a new course of action. Under the influence of this stimulus they would come towards the surface and migrate upstream in search of spawning-grounds. In this particular case the result would be to bring them to Baker Lake. From evidence obtained at other places it is known that the land-locked variety of the sockeye is small, being greatly inferior in size and weight to the normal race. Since the supply of food in a new water-body like Lake Shannon must be scanty at best, that will tend to accentuate the usual condition.

Last year a very few small strange fish were taken at Baker Lake. This year a considerable number of similar fish were captured about the last of August. Both male and female were present and ripe. Last year the few eggs that were taken were handled in the hatchery and the young hatched. Both the eggs and fry resembled those of the sockeye except that they were somewhat smaller. It seems clear that this is the beginning of a race of land-locked sockeyes. Once established, such a land-locked variety would naturally maintain itself. Because of its small size the type would be of little or no commercial value, although it might prove very attractive for sport-fishing,

I think that the variety, if given access to the sea after normal development in fresh water, would carry out the full life-cycle of the sockeye and serve to replenish the run in this stream. However, access to the sea seems likely to be denied to a certain as yet unknown part of the run in the river unless the new conditions introduced by the formation of Lake Shannon are in some way altered. It is important to determine how early the fish reach this lake, how long they continue to come down the river, and how long they will wait near the dam or at the surface of the lake for an opportunity to get over the dam and on down the river. It may easily be that some of them seeking food or for other reasons venture into deeper water soon after arrival at Lake Shannon, and even before they move along shore to the lower end. Those that leave the surface-water and find a cooler environment are not, in my opinion, likely to return to the surface. Accordingly it seems that, under the best of circumstances, some part of the run will be eliminated from the portion which continues to the ocean and participates in the part of the life-history which is of commercial importance.

Conditions just described adds another very important argument to those which have already been offered concerning the desirability of finding another method of solving the problem of power dams. If in such cases the entire run of adults could be captured below the dam and held there for ripening, and if the eggs were cared for and hatched at some accessible point, two evident and serious difficulties in the situation would be solved. It must not be forgotten that in the case of the sockeye-salmon the young fry must be kept and fed until of an appropriate age before they are set free into the river; for Gilbert, in the course of his study of scale-markings, has determined that no sockeye returns to fresh water except those which give evidence in scale-markings of having passed at least one year in fresh water before entering the sea.

SOME OTHER ENVIRONMENTAL INFLUENCES.

The third environmental stimulus which I believe affects the movements of the salmon is the quality of the water. At this point there are fewer experiments or bits of evidence that I am able to furnish personally. Nevertheless, I feel that much could be said in favour of the view from our knowledge of the structure of the fish. Their olfactory organs, by which the quality of the water can be tested, are very well developed—especially the nerve centres, with which the terminal organs are connected directly, are of a size and complexity that is conspicuous among all vertebrates, and beyond the size reached by these organs in most members of that group. It is legitimate to correlate activity of function with degree of structural development. Furthermore, there are some indications that this function is actively concerned in determining the movements of the salmon.

The most conspicuous instance is that furnished by Sulphur Creek, referred to above. Whereas many years ago the salmon showed no inclination to enter the waters of this creek, at the present date, as already explained, a number of sockeyes are attracted into the pools at its mouth. The conspicuous changes in the creek are two:—First, the volume of the water has been greatly reduced. If this influences at all the movement of the salmon, it is probably adverse to the conditions observed, *i. e.*, it probably would be less attractive to the fish than the Baker River, for on the whole the salmon choose the main flow of any stream. The second difference between Sulphur Creek to-day and before the changes were brought about lies in the quality of the water. The taste which gave it a name is to-day entirely lacking. The water is now clear, sparkling, and in every way attractive. At other places I have seen red salmon turn aside from a glacier-fed stream of large volume to enter clear, cold, spring-fed streams of much lesser volume, like Sulphur Creek to-day. In these cases it seems to be the temperature of the water which naturally attracts the salmon, but here that temperature did not previously attract these fish. It is justifiable to regard the bad taste or poor quality of the water previously as the deterrent factor.

Another instance I mention with more hesitation, because the conditions are not so clear or the conclusion so well justified. At the same time no other solution of the questions offers itself, and this appears to be a legitimate possibility. In the long wooden flume, built with successive steps upward and fed by an abundant flow of clean cold water, many of the salmon could not be persuaded to ascend, even though the volume and temperature of the water was experimentally modified in a great variety of ways. When they moved around the lower pockets, and with the nose tested the water coming out from the upper levels and the walls within which they were confined, they turned away, and, despite the attraction of the current, not only refused to follow the most conspicuous migratory instinct by moving upstream, but they diligently sought for some escape in another or even in the opposite direction. It was also noticeable that, at a trap built entirely of wood with a shallow bottom, the fish frequently poked their noses into the entrance and then withdrew, without making any effort to swim up against the current. It may well be that the fish did not like the quality of the water or of the trap *. More extensive observations of the sockeye would result in securing more and better evidence on this point, and in this section on the quality of the water I include my scanty observations rather to call attention to this part of the problem than to attempt to justify any very positive conclusion.

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* "Fishes recognize exceedingly minute quantities of numerous substances and . . . turn back upon encountering them."—Shelford, V. E., 1914, p. 28.

The amount and direction of the light is also significant in the movements of the salmon. They are most active in the morning and evening hours, when the light is moderated, and also on days that are cloudy or dark. One period of greatest activity follows the early morning, and along towards 10 A.M. all activity dies down, so that, as a rule, the salmon may be seen, if at all, during midday hours only resting in deep shady spots in the current of the stream. They resume their activity again later in the afternoon, when the sun has moved down far enough to eliminate direct and intensive illumination of the water. They continue moving until late in the evening and possibly into the night. The open-water jumping and splashing in which the sockeyes indulge when they are resting in eddies or moving through quiet stretches of the river is rarely, if ever, noticed during the midday hours from ten to three. Even on dark cloudy days it is rare to find them active at that time. This jumping, however, is active during morning and evening hours, and may be heard at times well into the night.

One is not justified in maintaining that the increase and decrease in activity is correlated merely with the corresponding change in the light, since that change is associated at the same time with temperature changes, and these may give the determining stimulus. A few experiments have been made by others interested in the possible effect of the light stimulus. Mr. Newberry has informed me that he hung an electric light directly over the water in one of the large pools in a concrete fish-ladder. The fish evinced a marked desire to avoid the effects of bright light. The silvers would jump actively and move up the ladder with speed, but the sockeyes apparently merely became alarmed and dashed about in the pool without apparent purpose.

Observations on the Skagit some years ago, before the conditions in this region were particularly modified by settlement, showed that the migrating sockeye moved during the night or the morning and evening hours, and lay quietly in deep pools during the more sunny periods of the day. Here, again, it is difficult to say whether the activity is influenced by light or heat, or both together.

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III.—*The Natural History of the Mud Shrimp* Upogebia pugettensis (*Dana*). By G. E. MACGINITIE, Assist.-Prof. of Zoology, Hopkins Marine Station of Stanford University.

[Plates I.–III.]

ONE of the most important traits which an animal may possess to become a successful marine mud-dweller is the ability in some way to use detritus as a source of food-supply. Through realization of this fact, the writer has been able to work out the natural histories of several mud-dwelling forms which would otherwise still remain a secret *. *Upogebia pugettensis* (Dana) belongs in this category, and the following account is a description of the feeding-habits of this mud-shrimp, together with other natural history notes regarding its general life-habits.

In a previous article † a method of food-getting by *Urechis caupo*, an echiuroid worm, was described as being unique for a detritus-feeder, and the present article dealing with the natural history of the blue-mud shrimp *Upogebia pugettensis* will describe a method of feeding upon detritus which is analogous to that pursued by *Urechis caupo,* but which is accomplished by utilizing entirely different structures. A comparative study of the two animals proves very interesting, both from an ecological and an evolutionary standpoint. A comparison of *Urechis caupo* with *Upogebia pugettensis* offers the best example of convergence which has yet come to the attention of the writer.

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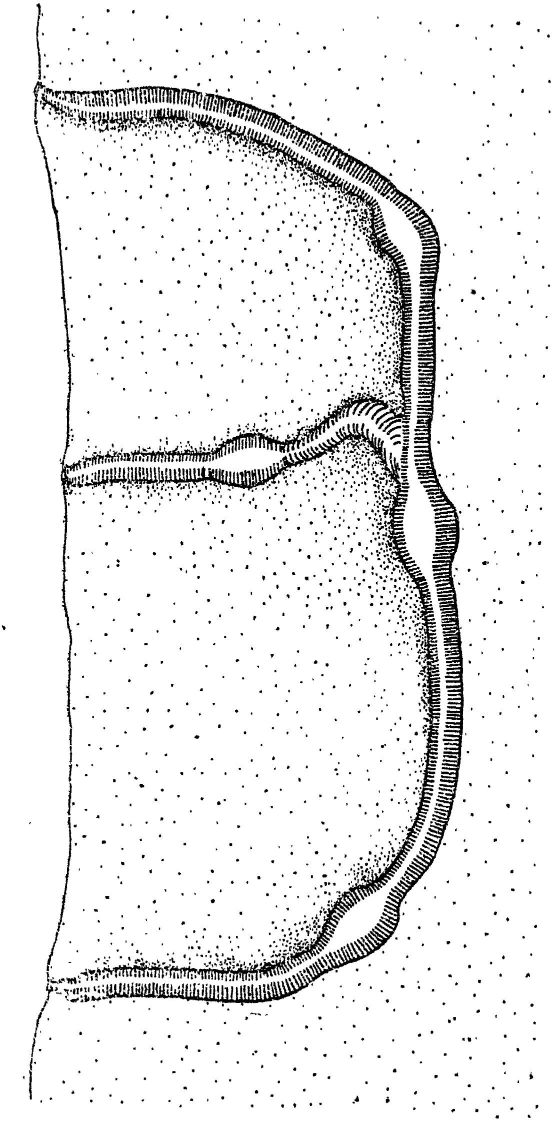
* This article will be followed shortly by "The Anatomy and Natural History of *Callianassa californiensis*, Dana," "The Natural History of *Pectinaria* sp.," and "Boring Movements and Natural History of the Clam *Zirfæa gabbi*, Tryon."

† Fisher and MacGinitie, "The Natural History of an Echiuroid Worm," Ann. & Mag. Nat. Hist. ser. 10, vol. i. p. 204.

The following study was made both in the field at Elkhorn Slough, a salt-water inlet of Monterey Bay, and at the Hopkins Marine Station at Pacific Grove, California. All specimens studied were from Elkhorn Slough, a description of which may be found in the paper referred to above.

The data which forms the basis of this paper was obtained by digging and exploring burrows in the Slough or by placing the animals in limoria in salt-water aquaria at the Station. The limoria were made of two pieces of glass 12 inches by 22 inches held 1¼ inches apart by a wooden frame. When one of these limoria was filled two-thirds full of mud, the animal could carry on its burrowing and feeding activities just as if it were in its native habitat, and, too, since the sides of the burrow were for the most part formed by the glass, observations of these activities were easily made. Glass burrows of 1-inch pyrex glass tubing were also made with "turn-arounds" blown at suitable places, and these proved very satisfactory to both the animal and the observer.

Upogebia pugettensis (Pl. I. fig. 1), of the Family Callianassidæ, Tribe Anomura, is a blue-mud shrimp from 3 to 4 inches long inhabiting mud flats on the west coast of North America from Alaska to Lower California. It builds burrows of considerable extent in the mud or sandy mud of slough bottoms or in the mud bottoms of estuaries. It is more abundant in regions where the soil contains a considerable amount of clay. Rocks and boulders offer no obstacle to the building of burrows by *Upogebia,* and they seem even more abundant in such places than where there are no rocks ; but it has been the experience of the writer that they are smaller in size in rocky regions. For example, at Hunter's Point, San Francisco Bay, and Newport Bay, Southern California, where they are very abundant in boulder-strewn beaches, the size averages 2 to 3 inches in length; while at Elkhorn Slough, in rock-free muddy soil, they average between 3 and 4 inches in length.



Semi-diagrammatic sketch of a *Upogebia* burrow excavated by the writer. × $\frac{1}{13}$.

Burrows.—The burrows of *Upogebia* extend downward from the surface, usually at an angle, for a distance of about eighteen inches, and then horizontally two or three or four feet before again coming to the surface. From the horizontal portion, which may be somewhat sinuous both laterally and vertically, one or two branched tunnels arise, and these may or may not lead directly to the surface, for sometimes they extend horizontally for two or three feet before turning upward. They branch in such a way that it is difficult to determine which is the main tunnel. There are usually three or four openings to a burrow. This is necessary, as will be seen later, as the shrimps are usually found in pairs. The openings of the burrow are small (1 centimetre in diameter), but beyond 3 centimetres from the surface the burrow enlarges to a size which comfortably accommodates the body of the animal. Here and there throughout its extent the burrow has enlarged semi-globular places where the animal can turn around, one of these "turn-arounds" being placed at or in close proximity to a point of branching. The distance between two separate openings varies, as do the shape and size of the burrows as a whole. Sometimes two openings of the same burrow may be separated by a distance of five feet. The text-figure shows a semi-diagrammatic sketch of a burrow excavated by the writer. The burrows are of such extent and depth that it is very difficult to excavate one during a low tide. The walls of the burrow are quite smooth and this is due for the most part to the rubbing of the walls by the body of the animal in its passage back and forth through the burrow; but it is also undoubtedly helped by the aid of an adhesive secretion from the animal while the tunnel is being constructed. The writer has seen the animal take loose sand and attach it to the upper side of a glass tube in the aquarium, which would be impossible were the sand not mixed with some cementing material secreted by the shrimp.

Burrowing.—The most interesting feature of *Upogebia pugettensis* is its mud basket (Pl. I. fig. 3), formed by the first two pairs of legs (Pl. II. figs. 1, 2), which have feather-like growths of hair on the anterior and posterior edges. This basket is used to carry mud and to collect food. When the shrimp is digging a tunnel this basket is filled by loosening the mud with the chelæ of the first pair and the dactyls of the second pair of legs. Then the sides of the basket are forced down around the loosened material in much the same manner that one would scoop up sand with both hands. If this mud is carried to the surface it is not taken outside, but is pushed through the entrance with the chelæ. If it is taken to some other part of the tunnel for repair work it is very carefully worked into the side of the tunnel and smoothed out with the movable fingers of the chelipeds. These fingers when closed against the immovable ones are almost at right angles to the axis of the propodus and thus are admirably adapted for tamping (Pl. I. fig. 3). As a burrow is being made or extended it is always very carefully smoothed and completed as the work progresses. When the animal is digging a burrow it takes a load of mud from the face of the tunnel and then backs to the nearest "turn-around," making the turn with the basket load, and then carries it ahead to the place of deposition. Whether with a load of mud or an empty basket turning is accomplished in the same manner that a young boy turns a somersault on the lawn, and the shrimp cannot turn in the burrow except at the places of enlargement.

Appendages and Locomotion.—*Upogebia pugettensis* has four pairs of swimmerets (Pl. III. fig. 5) and with these it keeps a current of water circulating through the burrow. The fanning movements of the swimmerets take place in the following manner:—The first pair appears to pick up the following three pairs, carry them ahead, and then release the fourth, then the third, and then the second, itself making the final movement backward. Then all four pairs move forward together again as though picked up by the first pair, and so on. The endopodites and exopodites scissor together on the forward movement, and at the same time the tips bend to the rear and the hair-fringes stream almost directly backward. During the fanning movement the pleopod is spread, and the hair-fringes stand out at right angles to the antero-posterior axis of the body. The hairs of the fringe of the pleopods also have lateral fringes of finer hairs (Pl. III. fig. 8), which are flattened in this same plane. These movements maintain a steady current of water through the burrow, and this fact is emphasized when one sees the shrimp swimming forward, for progress is uniform and not jerky as is the case when it swims backward by use of the tail-fan.

The tail-fan is so constructed that it can effectively block the burrow. If one digs into the burrow below the animal it immediately spreads its tail-fan and blocks the burrow so tightly that, even though the entrance at the surface is under water, no water will flow past the animal into the tunnel below. The writer has seen a *Upogebia* hold a head of ten or twelve inches of water with the tail-fan for several minutes.

The tail-fan has been described as "well-developed and adapted for swimming" *, but this shrimp has little use for the tail-fan as a swimming-organ, as it never leaves its burrow. However, this organ can be used for moving rapidly backward in the tunnel when occasion arises. An animal living in a burrow has two possible points of attack, and *Upogebia pugettensis* defends one with its chelipeds and the other with its tail-fan. When molested from the rear the animal will either go ahead or go backward to the nearest "turn-around" and reverse ends so as to face its adversary

Walking along the burrow is accomplished by use of the third and fifth pairs of legs, while the fourth pair is held up and outward against the sides of the burrow, thus serving as balancing organs (Pl. I. fig. 4). The animal thus uses half the circumference of the burrow when walking along it. When the shrimp is at rest the fourth legs are still used for holding itself upright. The fifth legs (Pl. III. fig. 3) with their end brushes are used for cleaning the body, and, in the case of an ovigerous female, also for cleaning and aerating the eggs. The gills and branchiostegite of one side are cleaned by the fifth leg of the opposite side. The tips of the third and fourth legs (Pl. III. figs. 1, 2) are equipped with teeth for traction.

Feeding.—*Upogebia* detects the presence of food in the water by means of its antennules. If detritus is introduced into the opening of the burrow, the flagellæ of the antennules begin to vibrate rapidly and the animal proceeds toward the entrance. When *Upogebia* feeds it approaches an entrance, spreads the first and second legs to form a basket (Pl. I. fig. 4), and then increases the fanning motion of the swimmerets. This increases the current of water past the animal and through the basket, which serves as a strainer to intercept all particles the food-laden water brings in. At short intervals the third maxillipeds (Pl. II. fig. 3) sweep outward and downward alternately to wipe out the inside of the basket, and the material thus collected is passed to the animal's mouth. The second maxillipeds take the food-material from the third by grasping it between the brushes on their inner surface while the third maxilliped is drawn upward between them. The second maxillipeds apparently always make three strokes when brushing the food-material from the third maxillipeds. From the second maxillipeds the food is worked into the mouth by lateral motions of the first maxillipeds and the maxillæ, all of which are equipped with bristle-like brushes on their inner surfaces, which are directed backward toward the mouth-opening. The mandibles are weak and, with the exception of the extremely hairy palps, seem to be of the least use of all the mouth-parts.

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* Schmitt, Waldo L., "The Marine Decapod Crustacea of California," p. 114.

The basket is held in such a way that the current of water must strain from the inside out, and the basket is so effective that the entire current must pass through in this way. The second walking-legs and the chelipeds with their long hairs are pressed tightly outward against the sides of the burrow, and as a result the carapace is pressed more firmly against the upper side of the burrow. The flattened anterior dorsal portion of the carapace and the broad rostrum are equipped with spines and tufts of hairs (Pl. I. fig. 2), which hold the animal in position in the burrow while fanning with the swimmerets. Otherwise the movement of these organs would cause the animal to move forward in the burrow as it would in the open water when swimming. The small spaces between the sides of the rostrum and the hairs of the carpus of the chelipeds is filled by the ends of the third maxillipeds, and an elongated tuft of hair along the outer sides of the peduncles of the antennæ (Pl. I. fig. 2).

The hairs of the different parts of the feeding apparatus are so constructed as to be very efficient in intercepting food-material. Fig. 5 of Pl. II. shows a section of a hair of the main basket with its V-shaped lateral fringes of minute hairs, the opening of the V being directed inward and ahead. This hair is typical of the main straining apparatus of the basket. The brush-hairs of the third and second maxillipeds are saw-toothed (Pl. II. fig. 4) for transferring food-particles from the basket to the inner mouth-organs. Several types of hairs are found on the maxillipeds, legs, and body. Fig. 6 of Pl. III. shows a common type from the second walking-leg. Fig. 7 of Pl. III. shows a portion of a hair which is typical of those found on the exopodites of the mouth-parts.

If a piece of clam-meat or other meat is dropped through the opening of the burrow into the basket while the animal is feeding, it usually is turned over in the basket a few times, then forcibly ejected through the entrance by a current of water caused by a quick forward movement of the tail-fan. However, it is sometimes allowed merely to drop through the basket into the tunnel. Large particles of any nature are thus ejected or allowed to accumulate in the burrow, and later cleaned out by either carrying them to an entrance and pushing them outside with the chelipeds or by forcing them out with a strong current of water made by vigorous fanning with the swimmerets.

Commensals.—Upogebia pugettensis has the same commensals as *Urechis caupo*: namely, a small pinnotherid crab (*Scleroplax granulata,* Rathbun) and a polynoid worm (*Harmothoë* sp.) *.

These commensals subsist on the larger particles of food dropped from the food-basket of their host. It is interesting to note that while the crabs with both *Urechis* and *Ubogebia* are the same, the polynoids, although of the same genus, are of different species. A forthcoming paper on *Callianassa* will give a third species of *Harmothoë*, while the crab with this host is still *Scleroplax granulata.*

A small goby fish (*Clevelandia ios,* Jordan & Gilbert) † makes occasional use of *Ubogebia* burrows for refuge from enemies and low-tide exposure.

General Remarks.—When *Ubogebia* is outside its burrow it is a very awkward and helpless creature. It apparently has little geotropic sense, sometimes rolling over on its side or back and waving its legs, remaining in this position without much attempt to right itself. It can swim backward quite rapidly in the water for short distances by use of the tail-fan, and more slowly forward, which seems to be the natural direction, by use of the swimmerets. Upogebias soon die if kept where they cannot come in contact with some object on all sides of the body.

At Elkhorn Slough, Upogebias are nearly always found two to a burrow, a male and a female. The females are ovigerous during the months of January and February.

In addition to the four pairs of biramous swimmerets mentioned above, the female possesses an additional uniramous pair of pleopods (Pl. III. fig. 4) on the first abdominal segment. This pair (which is entirely devoid of hair), together with the endopodites of the first, second, and third pairs of swimmerets, serve as attachment for eggs. An ovigerous female spends a a great deal of time aerating her eggs with fanning movements of the swimmerets, and cleaning them by manipulating them with the brushy dactyls of the fifth legs. This cleaning process is of vital importance, for eggs which are removed from the females, although kept well-aerated, soon become covered with diatoms and fungus-growths, and the larval shrimps finally die before hatching. Small specimens of *Upogebia* are very scarce at Elkhorn Slough, and this, for reasons given in a former paper*, leads one to the conclusion that *Upogebia* also is long-lived.

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* A new species now being described by the writer.

† Fisher and MacGinitie, *loc. cit.*

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. *Upogebia pugettensis*, Dana, in normal resting position. × ⅓.
Fig. 2. Lateral view of the anterior portion of *Upogebia* with the legs and third maxilliped of one side removed to show the inside of the basket. (Preserved specimen.) × ⅝.
Fig. 3. Ventral view of basket, × ⅝.
Fig. 4. *Upogebia* in feeding position, × ⅓.

PLATE II.

Fig. 1. Inner surface of cheliped, × 2½.
Fig. 2. Inner surface of second leg, × 2½.
Fig. 3. Outer surface of third maxilliped, the shorter hairs of which constitute a brush for removing food-particles from the inside of the basket. × 2½.
Fig. 4. Distal half of a hair from the brush of the third maxilliped, × 65.
Fig. 5. Portion of a long hair of the basket as shown on the lower side of the cheliped and second leg in figs. 1–2. × 40.

PLATE III.

Fig. 1. Outer surface of third leg, × 2½.
Fig. 2. Outer surface of fourth leg, × 2½.
Fig. 3. Outer surface of fifth leg, × 2½.
Fig. 4. Egg-carrier, or first pleopod of female, × 2½.
Fig. 5. Posterior view of swimmeret from the right side, × 2½.
Fig. 6. Portion of a hair from the upper margin of the second leg, × 40.
Fig. 7. Portion of a hair typical of those of the exopodites of the mouth-parts, × 40.
Fig. 8. Portion of a hair from a swimmeret, × 40.

IV.—*The Three-eyed Haddock*, Melanogrammus æglefinus, *a "Fake."* By Dr. E. W. GUDGER, Bibliographer and Associate in Ichthyology, American Museum of Natural History, New York City.

[Plate IV.]

IN the New York 'Herald-Tribune' for October 9, 1927, there appeared an announcement that a fisherman on the fishing-schooner 'Marjorie Parker' had caught a three-eyed haddock in the south channel of Boston Harbour. In the rotogravure section of the 'New York Times' for the following Sunday (October 16), there were pictures of the head of a haddock with three apparently good eyes, the third situated in the middle of the head about the diameter of the eye behind the centres of the normal eyes. It looked like a perfectly good eye, but somehow it seemed "fishy" to me.

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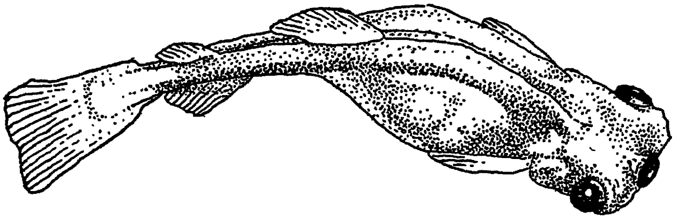
* Fisher and MacGinitie, *loc. cit.*

Every effort was made to find the fish, but in vain. I had letters from two men who saw it: one of them the manager of the fish wharf in Boston where it was landed, the other the photographer who made the original pictures. Both thought that it had gone to some museum in Boston, but letters to the Museum of Comparative Zoology and to the Boston Society of Natural History brought answer that neither had obtained it. The consensus of opinion finally was that it had been acquired by some private collector of curios. However, I have since learned that it was brought to New York, where it was seen by various parties, but I have not been able to trace it to its ultimate destination. It was, of course, exceedingly unfortunate that the fish did not come into the hands of some scientific man for careful examination and study.



A three-eyed trout embryo, length about 20 mm. The third eye is formed by the fusion of the two inner eyes of what began as a two-headed monster. (After Gemmill, 1912.)

My next effort was to secure the originals of the photographs reproduced in the 'Times.' Through the photographer referred to above, I was put in touch with the sales manager of Wide World Photos in New York, who courteously sent me copies of both the original photographs. From these, cuts were made and used as illustrations in an article which, because of the many delays in trying to trace the fish and find the photographs, did not appear until November 1928 *.

The better of the two figures is reproduced in Pl. IV., that the reader may get a clear idea of just how the head of this remarkable fish looked. In it the third and median eye looks like a perfectly normal eye—which it is.

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* E. W. Gudger, "A Three-eyed Haddock, with Notes on other Three-eyed Fishes," 'American Naturalist,' vol. lxxii. pp. 559–570, 6 figs.

In an effort to determine the credibility of this alleged phenomenon, I made a careful search through the literature of this particular branch of ichthyological teratology. I found a number of figures and descriptions of three-eyed *embryos*, chiefly trout from fish hatcheries, or the abnormal embryos of *Fundulus*, the common shore minnow, produced in the course of experimental work. The figures were reproduced and the accounts summarized in my article. It was soon seen, however, that all the third eyes in these embryos were either between the normal eyes or slightly anterior to a line joining their pupils. Furthermore, it was clear that all these median eyes were formed by the fusion of the two inner eyes of what would have been a two-headed monster. Then it was found that all such three-eyed monsters always died shortly after hatching, the largest recorded being only 28 mm. long, slightly over an inch. This fact, together with the anterior position of the third eye, as may be seen in Pl. IV., very effectually argued against this adult three-eyed fish being a grown up three-eyed little monster.

Then there were found references to two fishes of kinds other than the above, and one of them certainly an adult. One such monstrosity was a whiting * which had three eyes, two in the normal position and the third between them. Unfortunately, no fuller description was ever published, and in the short notice no size is indicated.

However, Professor Alexander Meek † had a three-eyed dab, 190 mm. (7·5 in.), sent in to the Dove Marine Laboratory at Cullercoats. Here follows his own statement of what was done and found:—

"The specimen was photographed, and a careful dissection was entered upon. I noted a small but not at all prominent transverse cut behind the important looking third eye, but that did not prepare me for finding the eye in question quite loose in a cavity behind the normal right eye. It was not connected with anything inside of the head. There was a remnant of the inferior oblique muscle, and the optic nerve had been cut close to the eye. I actually cut the latter into sections before I wrote in my laboratory diary, 'It was therefore a clever deception.'"

A few days after this episode a fisherman visited the laboratory and inquired if anyone had ever seen a three-eyed dab. On being confronted with the "faked" specimen, he confessed that he had made it up. He had practised on a number of fish until he was able to turn out a monster which deceived even the fishmongers. Several of these "fakes" had been placed in baskets of fish and sold in the market at North Shields.

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* C. W. Rose, "Notice of a Monstrosity in a Whiting (*Gadus merlangus*)," Report British Association Advancement of Science, 1863, Zoology, p. 105.

† "A Three-eyed Dab [*Hippoglossoides limandoides*]," Report Scientific Investigations Northumberland Sea Fisheries Commission for 1909-10, 1910, p. 44.

This made me more dubious than ever, for the thought inevitably arose as to whether the head of the fish shown in Pl. IV. had not undergone like manipulation. But, lacking the fish itself, I did not know what to make of it—the third eye in the figure *looked* perfectly normal. It seemed that it might possibly be the result of the abnormal development of the pineal gland or "third eye" found in *Petromyzon* and other lampreys, and in *Sphenodon* among lizards. To test this out, I next dissected three haddock heads, but could find no trace of this organ, but I did find a bony ridge or crest running backward along the top of the skull and growing steadily higher the further back I traced it. Indeed, at the point where the third eye is shown in the photograph, the crest is at least 0·5 inch high above the level of the skull.

This strongly negatived the idea that this could be an eye which had grown there. Furthermore, the pineal eye is in fishes a mere microscopic remnant or is lacking entirely, also it is much further forward than the third eye being studied. Again, the third eyes of all embryonic fish monsters are between or in front of the normal eyes, whereas this third eye is so far back as to be over the cerebellum and medulla. These facts then lead to the conclusion that this third eye could not be a pineal eye.

Next I made a careful study under a magnifying-glass of the third eye in the photograph, and still it looked like the perfectly good eye it was. Normal eyes, however, are set in sockets and their outer covering is a development of the general integument and shows an uninterrupted gradation into this. However, the outer covering of the third eye shown in the photograph is sharply delimited from the scaly skin, and in front seems to have undergone considerable disturbance.

As a result of prolonged study and careful weighing of these objections, I finally wrote:—

"I am forced to the conclusion that this third eye is a 'faked' one, as was the one in Meek's specimen of the dab; that skin, flesh and bone have been skilfully cut away, and another haddock eye has been dissected out and inserted in the artificial socket. If this is a 'faked' specimen (and no other conclusion seems possible) it must be acknowledged that it is skilfully done. And so skilfully has it been done that only after careful study of the whole matter has such a conclusion been reached by me. Study of the fish itself would of course clear up the whole question, but this unfortunately is impossible."

A year after publication of the article noted above, my attention was called to the "Ruminations of a Codfish Forker" in 'The Fishermen's Own Book' (New York, 1928, vol. viii. no. 4, p. 28), where I found the following statement:—

"Seems there was a three-eyed haddock brought in at T-Wharf. This don't impress me so much. I once had a buddy on one of these schooners, and he told me how he slipped up on a feller once, was sitting off by himself on the trip home. This old feller was a great one for whittling, real handy with a knife. Well, he was working on the head of a haddock, real careful like, and when he got through, he brought a fish eye out of his pocket and slipped it in the hole, just as neat as you please. Never saying a word, he drops the three-eyed haddock back with the other fish and the next day, folks was coming from far and wide down to the fish pier to see the latest wonder of the world, the three-eyed haddock."

Thus are substantiated the conclusions I arrived at by an examination of the literature of the three-eyed fishes and a prolonged study of the head of a haddock and of the figure. We have still to await the capture of a genuine three-eyed adult fish.

EXPLANATION OF PLATE IV.

Dorsal view of the head of the three-eyed haddock. Note the position of the third eye and its sharp differentiation from the scaly skin.

V.—*Descriptions and Records of Bees.*—CXXIV.

By T. D. A. Cockerell, University of Colorado.

Megachile felderi, Radoszkowski.

♀ ♂.—Foochow district, China (*C. R. Kellogg*).

According to the descriptions, the female *M. monticola*, Smith, has the hair of abdomen all black beyond the first tergite; *M. rhinoceros*, Mocsary, has white apical hair-bands on tergites 2 to 5, while *M. felderi* has a narrow reddish apical band on second tergite. On this basis, the present specimens are *M. felderi*, but, as Bingham intimates, these may be forms of a single species. The male seems to be like that of *M. monticola.* In both sexes the thorax is black-haired beneath. The tongue is about twice as long as the labial palpi. According to the character just cited, the *M. monticola* from Formosa is also *M. felderi.*

Ctenoplectra kelloggi, sp. n.

♂.—Length 12–15 mm. (with the abdomen curled downward and inward).

Head, thorax, and legs black, abdomen brilliant steel-blue. Very close to *C. apicalis*, Smith, from Burma (which Friese thought might be the male of *C. chalybea*, Smith), and perhaps only a race of that species, but legs black, and margins of first two abdominal tergites not at all brown. Comparing the original description of Smith, there seems to be little difference, but I noted at the British Museum that the apex of abdomen in *C. apicalis* was prolonged into long processes laterally (Smith says produced laterally into a blunt curved tooth, widest in the middle, with the margin rounded). In *C. kelloggi* this structure is quite different, taking the form of a broad short lobe, subtruncate as seen from behind, arched as seen from the side. In the type-specimen (15 mm.), the clypeal keel is very broad above, narrowing rapidly to a point, and ending before the middle of the clypeus; but in others, which I regard as the same species, the keel is strong and runs the whole length of the clypeus. The scape and base of flagellum are dark red in front. The wings are strongly smoky, somewhat reddish. The clypeus is not at all emarginate anteriorly, but perhaps Bingham's statement to this effect in respect to *C. apicalis* may be due to the appearance produced by a pair of low swellings at the base of the labrum. There is white hair on the raised anterior border of the prothorax, on the cheeks, and sides of face.

Foochow district, China (*C. R. Kellogg*).

Some authors, in recent years, have called this genus *Scrapter*. The type of *Scrapter*, designated by Vachal in 1879, is *S. bicolor*, Lep. & Serv. On reading the description of Lepeletier and Serville, I reached the opinion that *Scrapter* was really the genus *Strandiella* of Friese, although it included a mixture of things. M. R. Benoist, at my request, very kindly hunted up the original Lepeletier types in Paris. He found three bees which agreed perfectly with the original descriptions of the three species of *Scrapter*, labelled "Afriq., Cafrerie, Delalando," but with no names. There seems to be no doubt that these are the actual types. He thinks *S. punctatus* is an *Allodape*, as the tongue is sharp and agrees with that genus, but it is not identical with any species of that genus in the collection. In *S. niger* the mouth-parts cannot be clearly seen; but in *S. bicolor* it seems that the tongue, partly hidden under the head, is obtuse. *S. bicolor* and *S. niger* are males, and the seventh segment, with about the outline of the last joint of a finger, is clearly visible. There was unfortunately no *Strandiella* available for comparison. The character of the end of the male abdomen, as described and sketched for me by Benoist, agrees exactly with *Strandiella*, as does the blunt tongue. Thus, after remaining an enigma since 1825, I think the identity of *Scrapter* is at last settled.

Parevaspis basalis chinensis, subsp. n.

♀ (type).—Head, thorax, and legs black; abdomen entirely bright ferruginous; last sternite with a prominent keel, not reaching base or apex; wings rather dilute fuliginous.

♂.—Seventh abdominal segment broadly truncate, with three short teeth, the lateral ones hardly smaller than the median.

Foochow district, China (*C. R. Kellogg*).

As long ago as 1904, after examining Smith's type of *P. abdominalis* (*polynesia*, Vachal), I decided that the Chinese form with red abdomen was distinct, and regarded it as a variety of the Japanese *P. basalis*, Ritsema. Meyer (1921) separated it from *P. basalis*, and referred it to Smith's species. Again reviewing the subject, I offer the solution which seems to me most reasonable.

Xylocopa chionothorax, Cockerell.

Foochow district, China (*Kellogg*).

The type, described in 1907, was merely labelled "China."

Cœlioxys taiwanensis kelloggi, subsp. n.

♂ (type).—Markings of thorax above and the entire abdominal bands (composed of broad scales) warm ochreous; hair of face pale yellowish; mandibles entirely black; tarsi black; stigma reddish black.

♀.—Length about 9·4 mm.

With ochreous markings as in male; clypeus flat; face densely covered with cream-coloured hair, entirely hiding the surface; under side of thorax with dense silvery-white hair;

second tergite with a transverse elongated fovea at each side; sixth tergite keeled, its apical portion narrowed, more produced than in *C. brevis*; apical sternite narrow, produced far beyond tergite, moderately curved downward; venter with three broad white hair-bands, narrowed in middle; the hind coxæ are densely covered with hair, except a bare shining black spot.

Foochow district, China (*Kellogg*).

Recognized by the small size and the four conspicuous ochreous or fulvous spots on thorax above. *C. taiwanensis*, Ckll., is from Formosa; the Chinese form seems only to represent a subspecies.

Habropoda percarinata, sp. n.

♂.—Length about 14 mm., anterior wing 10.

Black, with yellow face, mainly red legs, and abdomen partly red; eyes prominent, dark red, orbits diverging above; face below antennæ all yellow except a narrow stripe at each side of upper half of clypeus; supraclypeal mark large, broadly triangular; lateral face-marks extending up to antennæ, and with a lobe between antenna and eye; clypeus dull, elongated, strongly keeled down the middle; labrum large and yellow; malar space short; mandibles pale yellow except the black bidentate end; hair of face, front and vertex pale red, thin and long; cheeks with long whitish hair; scape black above, reddish yellow below; flagellum dark, faintly reddish beneath; thorax above with dense bright fox-red hair, beneath with whitish hair; tegulæ clear fulvous. Wings fulvo-hyaline; marginal cell not greatly produced; basal nervure very long, meeting nervules; second cubital cell very large and broad, receiving first recurrent nervure at end. Anterior and middle femora, tibiæ and tarsi clear light ferruginous, with thin pale reddish hair, their coxæ and trochanters somewhat rufescent; hind legs with trochanters shining black, produced and pointed apically; femora greatly swollen, red, with a large black area occupying most of upper side, but not reacing apex; tibiæ red with black base, apex broadened; tarsi black or nearly so. Abdomen dull, with a strong purple lustre; first two tergites red, with black bands, that on first divided into three spots, the middle one broad, that on second broad, angularly extended toward the base in middle; remaining tergites black with broad light reddish margins, the extreme base of third and fourth red; the abdomen is covered with thin fulvous hair, not conspicuous, and the margins of the tergites are ciliated with shining hairs; toward the apex the hair on discs of tergites becomes brown, and at sides of apex it is black.

Foochow district, China (*Kellogg*).

Closely allied to *H. fulvipes*, Cam., but the clypeus is not so long, and the abdomen and legs differ in various details of coloration. There is a strong superficial resemblance to *H. magrettii*, Bingh., in which the clypeus is not keeled. The base of first tergite has a bilobed black area, a further mark of distinction from *H. fulvipes*.

Habropoda nubilipennis, sp. n.

♀.—Length about 13 mm.

Robust, black, with the aspect of *Anthophora confusa*, Sm.; eyes dark brown, inner orbits parallel; clypeus coarsely punctured and obtusely carinate, the broad apical margin and a narrower median stripe light yellow; a transverse but not triangular supraclypeal mark, large triangular lateral face-marks (ending acutely on orbit at level of antennæ), large basal spot on the otherwise brown labrum, and basal half of mandibles, all light yellow; mandibles robust, curved, reddened beyond middle, and black and bidentate at apex; hair of face very scanty, partly pale and partly fuscous, of front thin and pale, but some fuscous on upper part and vertex, but occiput with long pale fulvous hair; lower part of cheeks with long white hair; cheeks above bounded by a keel, which is continued across the top of head, behind the ocelli; antennæ black, obscurely reddish beneath; thorax densely covered with fulvous hair; tegulæ light fulvous. Wings short, dusky, shining, with dark nervures, the second cubital cell rather small, receiving first recurrent nervure at end; the membrane is strongly glaucous. Legs dark reddish (not ferruginous), with fulvous hair; hind spurs long and pale; abdomen finely punctured, with a strong glaucous or bluish tint, tergites 2 to 4 with narrow cream-coloured bands; sides of apex with long reddish-black hair; penultimate sternite fringed with red hair, but the three before it with whitish hair.

Foochow district, China (*Kellogg*).

This cannot be the female of *H. percarinata*, the wings being quite different. It is smaller than *H. pekinensis*, Ckll., with quite different abdominal bands.

Anthophora pingshiangensis, Strand.

Both sexes.—Foochow district, China (*Kellogg*).

This appears to me to be a valid species, though very near to *A. acervorum* (L.), var. *squalens*, Dours.

Anthophora tsushimensis, Cockerell.

♂.—Foochow district, China (*Kellogg*).

The fourth tergite has a broad band of yellowish-white hair, but that of fifth and sixth is all black. In the original description for segments 2 to 6 with white hair-bands, read 2 to 4. In the discussion it is stated that there is no band on fifth tergite. This species is allied to *A. urens*, Ckll. It is new to China.

Anthophora mesopyrrha, sp. n.

♀ (type).—Length about 16 mm., anterior wing 11.

Black, very robust, the occiput, thorax, and first tergite densely covered with bright fox-red hair, paler but not white on under side of thorax; eyes dark brown; hair of lower part of cheeks long and white, of labrum pale red and abundant, of clypeus thin, erect, and black, of region of antennæ, right across face, light clear ferruginous, of front and vertex mixed black and red, much black about ocelli; clypeus coarsely rugoso-punctate; face-marks dull yellow, consisting of a narrow central line, broadening apically, lower border narrowly, and lower corners broadly, on clypeus, a stripe at each side of clypeus, not reaching upper end, and supraclypeal mark in the form of a very low triangle; malar space linear; base of mandibles broadly yellow, apical half black; labrum large, broader than long, dull yellow except base and apical margin; antennæ black, obscurely reddened beneath, flagellum stout and shining, third joint longer than next two together, but not as long as next three; tegulæ dull copper-red. Wings strongly reddish fuscous; basal nervure falling a little short of nervulus. Legs black, tibiæ with red hair on outer face and black on inner; a tuft of red on hind knees; middle tarsi with black hair, but pale red posteriorly; hind basitarsi with black hair, but a tuft of red at base, and on inner face a broad band of short deep red hair; spurs long and black. Abdomen dull; first tergite clothed with light red hair, second with appressed pale fulvous hair forming a broad apical band, not sharply defined, third with a narrow distinct creamy-white apical band, fourth and fifth with black hair, and no bands, at each side of apical plate is some short red hair; venter with black hair.

♂.—Length about 14 mm.

Face-markings similar to those of the female, except that the lateral marks are large and triangular, reaching from clypeus to orbit, and the labrum is clearer yellow and has the black reduced; scape with a rather small yellow mark in front; third joint short and broad, hardly longer than fifth; legs not modified.

Foochow district, China (*Kellogg*); four females and three males.

There is a very close resemblance to *A. urens*, Ckll., from Formosa, but the antennæ of the male readily distinguish it. From *A. florea*, Sm., it is readily known by the abdominal banding.

Panurginus ogloblini, sp. n.

♀.—Length about 6 mm.

Pure black, with scanty dull white pubescence, long and conspicuous at sides of thorax; eyes very dark reddish; face broad; clypeus shining, punctured, the upper part microscopically tessellate and dullish; there is a more or less evident transverse sulcus in the subapical region; process of labrum very broad, simple; supraclypeal area polished; front, and sides of face, dull; ocelli prominent, in a low triangle; antennæ black, with the flagellum, except at base, dull rufous beneath; antennal joints 4 to 6 very short and broad, transverse; mesothorax dull, microscopically tessellate, the median sulcus deep; scutellum similarly sculptured; area of metathorax triangular, poorly defined, showing under the microscope a prominent sharp median ridge, and irregular wrinkles over the surface, producing an irregular reticulation; the sides are not shining; tegulæ dark brown. Wings ample, greyish; stigma large, dark reddish brown, nervures brown; basal nervure falling short of nervulus; second cubital cell long, receiving first recurrent nervure a considerable distance from base, and second nearer apex. Legs black, with pale hair. Abdomen shining, the hind margins of tergites faintly brownish.

Loreto, Misiones, Argentine, Aug. 26, 1929 (*A. A. Ogloblin*).

Evidently related to *P. brunneicornis*, Strand, from Paraguay; but the antennæ are darker, and the metathorax differs, as I gather from Strand's short description. There is, however, so little information about *P. brunneicornis* that it is difficult to form any exact idea of its characters. From *P. vagabundus*, Ckll., the new species is easily known by he dull mesothorax and dark tegulæ. From *P. herbsti*, Friese, also by the dull mesothorax. From *P. argentinus*, Schrottky, by the black abdomen.

P. ogloblini was taken in numbers by Dr. A. A. Ogloblin, along with many specimens of both sexes of *Protandrena meridionalis*, Schrottky. He finds in both these species parasitic Strepsiptera closely related to *Crawfordia*, Pierce, a genus based on two species occurring on *Panurginus* in Nebraska and New Mexico. It is very interesting to find these bees of the genera *Panurginus* and *Protandrena*, characteristic North American genera, in southern South America, and there infested by similar parasites. I sent specimens of *Protandrena meridionalis* to Mr. P. H. Timberlake for anatomical study, and, after making comparisons with the North American *P. asclepiadis*, Ckll., he reports: "they seem to be essentially alike in general form, type of coloration, mouth-parts, venation and genitalia, of course with very strong specific differences."

Although *Protandrena* is a characteristic North American genus, it is really closely allied to the South American *Psænythia*—so much so that it could perhaps be regarded as a subgenus. These insects are Panurgids with three cubital cells, and by this token should be the most primitive members of the family.

Halictus albescens convolvuli, subsp. n.

♀ (type).—Resembles *H. salsettensis*, Ckll., but easily distinguished by the much darker, reddish-brown stigma and darker nervures. The wings are conspicuously dusky, and the tegulæ are nearly black, with a light red discal spot and rather pallid margin. The hind spur has five spines, but in one specimen, certainly not another species, there are two spines and a long low lamella (*H. salsettensis* has three stout spines and a nodule).

♂.—The wings are clear, but the stigma and nervures are dark; clypeus entirely black; antennæ long and dark, the fourth joint reddened beneath; mesothorax and scutellum excessively polished and shining.

Siam: Nan (type-locality), Jan. 1 (*M. Collier and W. P. Cockerell*), Jan. 8 (*Cockerell*), and Jan. 24, at flowers of white convolvulus (*Cockerell*). These are all females; one female and three males were taken at Csjun, on the Nan River, Jan. 28 (*Cockerell*).

This is an easily recognized race, but in investigating it I was compelled to review the group of *H. albescens*, Smith, which is wide-spread and includes a number of local forms or species. At the British Museum, years ago, I made the following table :—

Mesothorax posteriorly dullish and punctured (Bombay district)	*senescens*, Smith, type.
Mesothorax posteriorly polished, like the scutellum.	
Area of metathorax highly polished, with weak sculpture	*lahorensis*, Cam., type.
Area of metathorax dullish, closely sculptured except along margin	*albescens*, Smith, type.

I further noted : These three are almost exactly alke, and have the abdomen obscurely red-brown (it is pure black in *convolvuli*) ; I am not sure that they are not forms of one species. I also specially noted of *H. lahorensis*, type, stigma dull sepia; area of metathorax very shiny, with weak rugæ. Distinctly larger than *H. emergendus*, Cam.; third cubital cell much shorter than in *H. constrictus*, Sm.

Later (1926) Blüthgen considered this group, which he classified as follows :—

(1) *H. albescens*, Sm. (*senescens*, Sm., *albozonatus*, Sm., *bengalensis*, Cam., *manilæ*, Ashm., *javanensis*, Strand, *luzonicus*, Strand, *amblypygus*, Strand, *javanicus*, Friese (♀, not ♂)).

(2) *H. albescens lahorensis* (Cam.) (*salsettensis*, Ckll., *reepeni*, Friese, *bryanti*, Ckll., and (?) *postlucens*, Ckll.).

(3) *H. albescens insularis*, Blüthg. Larat and Wetter Is. ; Timor.

(4) *H. albescens gibber* (Vachal). Coast of Red Sea ; Assuan ; Egypt ; Palestine.

At the F.M.S. Museum (Kuala Lumpur) I found a long series from the Malay Peninsula labelled *H. albescens*, Sm., and noted :—♂. Head oblong ; clypeus all black ; antennæ black (Smith says rufo-testaceous) ; legs black ; first recurrent nervure meeting intercubitus. ♀. More robust; area of metathorax glistening, rugose, ill-defined; scutellum highly polished ; fairly large species.

I can tabulate material in my collection thus :—

Smaller and less robust; tegulæ bright rufo-fulvous (Smith says rufo-testaceous) (Matheran)	*senescens*, Sm. [(det. Nurse).
Larger and more robust, with dark reddish tegulæ.	
Mesothorax rougher and more coarsely punctured ; area of metathorax strongly rugulose ; stigma darker	*luzonicus*, Strand [(Philippine Is.).
Mesothorax more finely punctured ; area shining, with feeble basal plicæ ; stigma lighter (Nasik, India).................	*salsettensis*, Ckll.

The male of *H. luzonicus* is very like that of *H. convolvuli*, but easily distinguished by the flagellum largely red beneath, the mesothorax conspicuously punctured, and the area of metathorax much more strongly sculptured.

I can only conclude that Blüthgen's synonymy must be revised. The Philippine *H. luzonicus* appears to me to be a good species. *H. senescens* appears to be valid, as Bingham held, though it may have to rank as a subspecies. *H. salsettensis* is not exactly *H. lahorensis*, but apparently not more than a race of it. It may well be that *H. lahorensis* is specifically distinct from *H. albescens*, in which case the Siamese *convolvuli* will rank as a subspecies of the former. Some of the other names cited by Blüthgen appear to represent at least distinct races, but it is not necessary to discuss them now. Whether we agree with Blüthgen's synonymy or not, he has done a service by his recognition of a group of forms, all closely allied, extending right across southern Asia.

VI.—*Fisheries Survey of Lakes Albert and Kioga: Report on* Notonectidæ *and* Corixidæ. By G. EVELYN HUTCHINSON, M.A., F.L.S., F.E.S.

(From the Osborn Zoological Laboratory, Yale University.)

MR. W. E. CHINA has most kindly entrusted me with a small but exceedingly interesting collection of Notonectidæ and Corixidæ from Central Africa deposited in the British Museum by Mr. E. B. Worthington. Thirteen determinable species are represented, including a remarkable new member of the genus *Corixa*. Certain problems relating to the distribution of these insects are discussed below, after the enumeration and description of the species collected.

Notonectidæ.

1. *Anisops* (*A.*) *sardea*, H.-S.

KENYA: Machakos, dam, 3. vi. 1928, 1 ♂, 3 ♀ ♀ (*R. E. Dent*).

Widely distributed in Africa from the Mediterranean almost to the Cape of Good Hope, also S. Europe and W. Asia.

2. *Anisops* (*A.*) *pellucens*, f. *pellucens*, Gerst.

KENYA: Machakos, dam, 3. vi. 1928, 1 ♂, 4 nymphs (*R. E. Dent*).

Nymph 8·5 mm. (last instar). Greyish white, abdomen red, marginally with a lateral black spot on each segment, anteriorly suffused with grey. Head and eyes about six times as wide as vertex, which is rather over once and a half as wide as synthlipsis.

The full-grown nymph is easily recognized by its large size.

Widely distributed in eastern C. Africa from Abyssinia to S. Rhodesia, also in Madagascar.

3. *Anisops (A.) balcis*, Hutch.

KENYA: Kisumu, Lake Victoria, swamp, 22. vii. 1928, 2 ♂ ♂, 5 ♀ ♀ (*E. B. Worthington*). Otherwise known from the lowlands (under 8000 feet) of Central Abyssinia.

4. *Anisops (A.) debilis*, Gerst.

KENYA: Machakos, dam, 3. vi. 1928, 1 ♂, 2 ♀ ♀ (*R. E. Dent*).

Widely distributed in Central Africa from Senegal to the Eastern Cape Province.

5. *Anisops (A.) varia*, f. *varia*, Fieb.

KENYA: Machakos, dam, 3. vi. 1928, 1 ♀ (*R. E. Dent*).

The single female undoubtely referable to this species is 8·6 mm. long, and has distinct traces of red on the anterior part of the pronotum, in spite of preservation in alcohol. It is infected with a rich fungal growth, but is otherwise without any signs of decomposition, so that it is difficult to believe that it was not taken alive and preserved immediately, in which case the fungus must have been a parasite *. Two other female specimens from the same locality, 6·5 and 6·6 mm. long, and without red on the anterior part of the pronotum, may be referable to f. *scutellata*; a precise identification of this smaller and less characteristic form is impossible in the absence of a ♂. Both forms are known to coexist in Kenya.

Anisops (A.) varia is known throughout most of the Ethiopian region and in parts of Western Asia and Eastern Europe; it is, however, apparently replaced by allied species in Uganda and Abyssinia.

6. *Anisops (A.) psyche*, Hutch.

KENYA: Kiambu, swamp, 9. vii. 1928, 3 ♂ ♂ (*R. E. Dent*).

Widely distributed in C. Africa from Abyssinia to the Northern Transvaal.

7. *Anisops (A.) amaryllis*, Hutch.

KENYA: Kiambu, swamp, 9. vii. 1928, 1 ♂ (*R. E. Dent*).

A single ♂ is probably referable to this rather imperfectly known species. The comb is somewhat wider than in the type, and the anterior margin of the claws lacks the crimson line characteristic of this species and *A.* (*A.*) *prætexta,* Hutch. It is, however, highly probable that the pigment is somewhat soluble in alcohol, specimens of other species being frequently decolourized by fluid preservation.

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* Since the above was written, this specimen has been submitted to Dr. R. Poisson, who concludes that the filaments are algal and not a parasitic fungus. I am much indebted to Dr. Poisson for this determination.

It is hoped that further material will be shortly available from this part of Africa which may throw light on the relationships of *A.* (*A.*) *amaryllis* and its allies.

The somewhat damaged type is from Nairowa Pass, Kenya.

8. *Anisops* (*Micranisops*) *apicalis,* Stål.

KENYA: Kisumu, Lake Victoria, swamp, 22. vii. 1928, 1 ♂, 1 ♀ 3·0 mm. (*E. B. Worthington*).

Widely distributed in Central Africa from Abyssinia to S. Rhodesia.

9. *Nychia limpida limpida,* Stål.

KENYA: Kisumu, Lake Victoria, 15. viii. 1927, 1 nymph, 3·0 mm. (*E. B. Worthington*).

UGANDA: Kasenyi, Lake Albert, 10. v. 1928, f. *limpida,* 9 brachypt. ♂ ♂, 1 macropt. ♀, 1 brachypt. ♀; trans. f. *sappho,* Kirk., 2 brachpyt. ♀ ♀ (*E. B. Worthington*).

One specimen from Kasenyi has some pale smoky pigmentation along the costa and a broad very pale smoky band along the outer margin of the corium, reminiscent of, but paler than, the condition in the subspecies *bantu,* Hutch., from the Linyanti River.

The other specimens are typical in this respect, the macropterous female especially being white, without the heavy greyish-black elytral colouring found in full-winged specimens of that form. The specimens referred to as trans. f. *sappho* have very feebly developed greyish elytral spots.

Nychia limpida is widely distributed in Africa from the Mediterranean to the Western Cape Province, but apparently does not reach the south-western extremity of the continent.

Corixidæ.

10. *Micronecta scutellaris,* Stål.

UGANDA: Mahagi Port, Lake Albert, pool, 28. iii. 1928, 1 ♂ (*E. B. Worthington*).

Widely distributed throughout almost the whole of the Ethopian region.

11. *Micronecta denticulata,* Hutch.

KENYA: Kisumu, Lake Victoria, swamp, 2 ♂ ♂, 2 ♀ ♀, 2 nymphs (*E. B. Worthington*).

UGANDA: Mahagi Port, Lake Albert, pool, 28. iii. 1928, 1 ♂, 1 ♀ (*E. B. Worthington*).

Otherwise known only from Lake Zwai in Abyssinia.

12. *Micronecta druryana*, Hutch.

UGANDA: Mahagi Port, Lake Albert, pool, 28. iii. 1928, 2 ♂♂, 6 ♀♀ (*E. B. Worthington*).

Otherwise known only from the Upper Zambezi river system, but presumably very wide-spread in Central Africa. The specimens under consideration are paler than the typical series.

13. *Corixa mirandella*, sp. n.

Dark brownish yellow with pitchy-brown markings, eyes dark reddish brown, legs yellowish or yellowish brown throughout. Pronotum dark brown with about twelve transverse yellow lines, anastomosing, especially on the disc; anterior two or three interlinear spaces hardly wider than, the others distinctly narrower than, the yellow lines. Elytra with dark colour dominating over light; clavus pitchy brown, with transverse yellow lines, three of which are dilated in the anterior inner angle, somewhat reduced on disc and slightly fragmented; corium pitchy brown, with transverse vermiculate fragmented lines which are not longitudinally seriated; right membrane pitchy brown with yellow vermiculations, ground-colour paler and markings darker in the inner angle, left membrane with dark colour obsolescent in the inner half, inner angle unpigmented.

Head with vertex obtusely and evenly rounded, eyes moderate, least interocular distance about half the greatest breadth of head and eyes. Fourth antennal joint short, 55 per cent. the length of third.

Pronotum $1\frac{7}{8}$ times as wide as long, lateral angles obtuse, obscurely longitudinally carinate throughout, feebly and irregularly puncto-rastrate. Lateral lobes of prothorax subtrapeziform (fig. 1, *e*). Xyphus elongate, acutely rounded apically (fig. 1, *f*).

Clavus distinctly but feebly rastrate, corium very feebly and irregularly rastrate.

Intermediate leg simple, without a specialized spine-bundle at the apex of the femur or an emargination at the base of the tibia in either sex; tibia about $1\frac{1}{4}$ times as long as tarsus, which is very slightly longer than the claws.

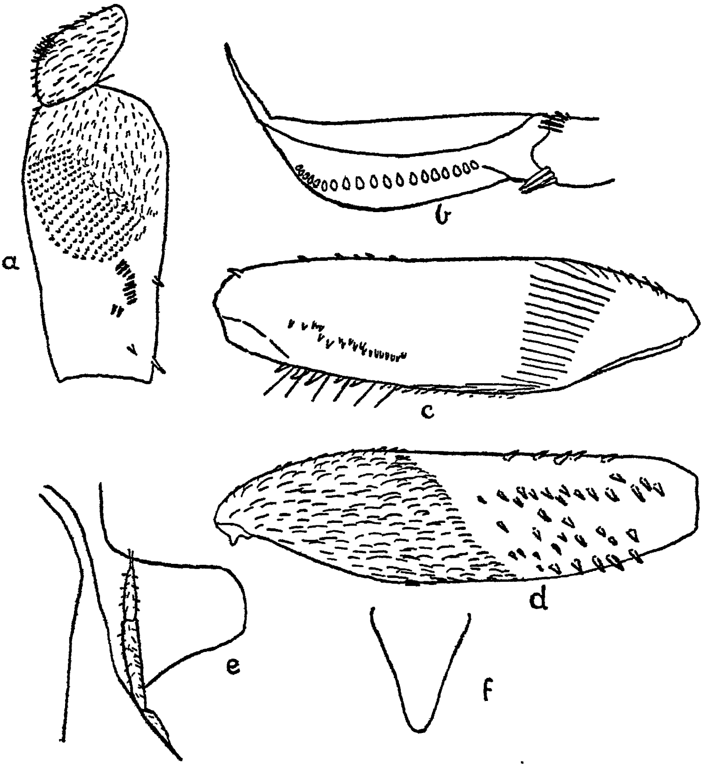
Posterior femur above with a long spine-row in its distal half near the posterior margin (fig. 1, *c*), below with boundary of proximal pubescent area crossing the middle of the femur in the mid-line, distal half with irregularly disposed spines, five moderate spines on the anterior margin, and five large spines just within the apical tuft of elongate hairs on the posterior margin.

♂.—Facial impression very feeble, extending upward but little between the eyes.

Anterior coxa with a small hair-pencil just anterior to its centre; femur with a well-developed stridulatory area of about eighteen rows of spiniform hairs, with a longitudinal row of spines between the stridulatory area and the apex, and several other spines disposed inside and outside it (fig. 1, *a*); tibia with a conspicuous apical bundle of spiniform hairs borne on a slight ridge near the outer margin, and a less conspicuous one on the internal margin; pala elongate, subparallel, with a row of nineteen pegs, the fourteen proximal pegs set in a straight line, making a definite obtuse angle with the five distal ones (fig 1, *b*).

Fifth abdominal segment with a spinous prestigilar area on its left side (fig. 2, *a*), strigil elongate-ovoid, of seven rows of combs (fig. 2, *b*), seventh abdominal segment with a moderately produced median lobe which bears a conspicuous tuft of hairs (fig. 2, *c*).

Fig. 1.



Corixa mirandella, sp. n., ♂.

a, anterior coxa and femur; *b*, pala; *c*, posterior femur, dorsal surface; *d*, posterior femur, ventral surface; *e*, lateral lobe of prothorax and antenna; *f*, xyphus.

Left paramere arcuate, swollen on its outer margin in the distal half with a subapical internal flange, beyond which it is narrowly pointed (fig. 2, *d*).

Right paramere elongate (fig. 2, *e*).

Apex of ædeagus as in fig. 2, *f*.

♀.—Slightly larger than ♂.

Anterior femur without stridulatory area, but otherwise as ♂; anterior tibia without the outer bunch of spinous hairs.

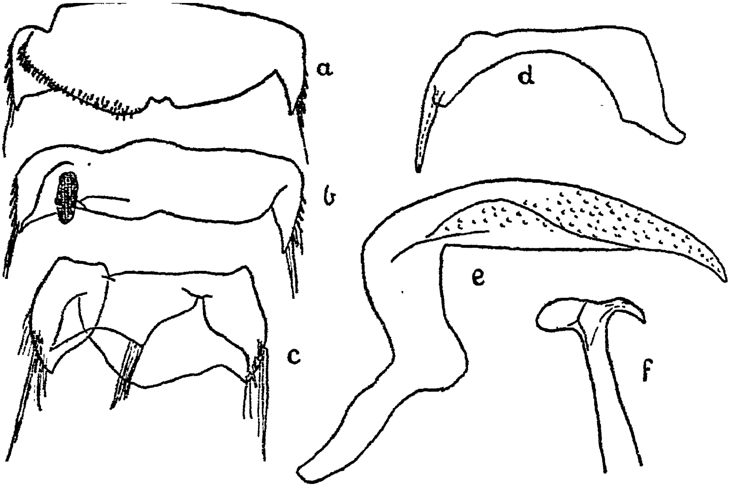
Length, ♂ 8·0 mm.; ♀ 8·5 mm.

Nymph, 6·5 mm. Length, 6·5 mm. (last instar).

Dull greyish to dark brown, dark median abdominal markings inconspicuous. Anterior femur as in adult ♀; posterior femur as in adult, but with only ten spines in the dorsal spine-row.

KENYA: Naivasha, "opposite Danns," i. 1928, *type* (♂), *allotype* (♀), paratypes (6 ♂ ♂, 14 ♀ ♀), and 5 nymphs (*R. E. Dent*).

Fig. 2.



Corixa mirandella, sp. n., ♂.

a, fifth, *b*, sixth, and *c*, seventh abdominal segments; *d*, left paramere; *e*, right paramere; *f*, apex of ædeagus.

The sinistral asymmetry, elongate xyphus, armature of the anterior tibia in the ♂, and of the posterior femur in both sexes, as well as the form of the strigil and ♂ pala leave little doubt that this species is rightly referred to the Palæarctic genus *Corixa*, Geoffr. *C. mirandella* is, however, very small for its genus, and the elytra, particularly on the clavus, are faintly rastrate. In both these characters it comes close to the genus *Sigara*, and may be regarded as a link between the known species of *Corixa* and those species of *Sigara* for which Jaczewski (1924) has created the subgenus *Anticorixa*. The lateral lobes of the pronotum are, however, less trapeziform than in either *Anticorixa* or the other species of *Corixa*, nor is a coxal hair-pencil known otherwise in either group.

Neocorixa, from Arizona, combines rastration with sinistral asymmetry, but in it the strigil is described as consisting of a curious patch of short hook-like projections not arranged conspicuously in rows * (Hungerford, 1925). It is clear that *Neocorixa* has no close connection with *Corixa*, and may be left out of account in discussing the present species.

Corixa mirandella is therefore a species of *Corixa* annectant to *Sigara* and possessing certain characters (small size and rastration) which may be reasonably regarded as primitive for its genus.

The flange on the left paramere is a curious specialization which seems to have no morphological relations with other parts of the copulatory apparatus, at least in preserved material; the general form of the paramere is more reminiscent of that of *C. dentipes*, Thoms., than that of any other species.

The nymphs of *Corixa mirandella* may presumably be distinguished from those of other Corixinæ living in the same region by the long spine-row on the dorsal surface of the posterior femur.

DISTRIBUTION AND ASSOCIATION OF VARIOUS SPECIES.

Though doubtless many further forms remain to be discovered, the present collection enables some estimate of the Notonectid and Corixid fauna of Kenya to be made. A number of species obtained by Mr. G. L. R. Hancock (Hutchinson, 1928 *a*, *b*) from around Kampala, viz., *Anisops* (*A.*) *ares*, Hutch., *A.* (*A.*) *hancocki*, Hutch., *A.* (*A.*) *eros*, Hutch., *A.* (*A.*) *adonis*, Hutch., and *Sigara* (*S.*) *chinana*, Hutch., are absent from the collection, as are all species of *Enithares* and *Agraptocorixa*. While some of these deficits will almost certainly be made up by future collections, it seems unlikely that others are not due to a real faunistic difference between the two regions. The dam at Machakos is the only locality from which four species of *Anisops*, viz., *sardea*, *pellucens*, *debilis*, and *varia*, occurred. These are all very widespread and common Central African species, but serve to show that here, as in South Africa, the advent of European colonization may do much to provide habitats for these insects.

On the other hand, the material from Kisumu indicates a more specialized association, viz., *Anisops* (*A.*) *balcis*, *A.* (*Micr.*) *apicalis*, *Nychia l. limpida*, and *Micronecta denticulata*, almost identical with that discovered by Mr. J. Omer-Cooper in the marshes around Lake Zwai, in Abyssinia, where these four species occurred associated with *Sigara* (*S.*) *hedenborgi*, Lundblad. It is probable that similar associations will be found in lacustrine swamps in other parts of Central Africa. The presence of *A.* (*A.*) *balcis* and *M. denticulata* in the present collection confirms the suggestion made previously (Hutchinson, *in press*) that while the upland fauna of Abyssinia probably contains strictly endemic species the lowland fauna has a wide distribution in north-eastern or in central Africa.

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* Cf. *Trichocorixa wallengreni* (Stål), from the Pacific region, in which the sinistral strigil is similarly constituted (Lundblad, 1929).

PALÆARCTIC ELEMENTS IN THE ETHIOPIAN FAUNA.

The species of the subfamily Corixinæ inhabiting the Ethiopian Region belong for the most part to two genera, *Sigara* and *Agraptocorixa*. The latter genus (incl. *Porocorixa*, Hale) has a very wide-spread distribution in Central Africa, Asia, and Australia, and may be described as an Old-World tropicopolitan form. *Sigara* is cosmopolitan, but practically all the Ethiopian species agree among themselves and with their congeners in S. America, Asia, and Australia (Jaczewski, 1927 *a*, *b*; Lundblad, 1928 *b*, 1929) in having a wide denticulate or crested right paramere. In only one case, *S.* (*S.*) *kilimandjaronis*, Kirk., is there any indication of a close alliance with any Palæarctic member of the genus. This species, so carefully redescribed by Lundblad (1929), shows many striking resemblances to *Callicorixa** *concinna* (Fieb.), and it is difficult to avoid the conclusion that *S.* (*S.*) *kilimandjaronis* and *C. concinna* had a common ancestor, the reduction of the strigil proceeding more rapidly in the Palæarctic than in the Ethiopian species, which still possess two small combs. *S.* (*S.*) *kilimandjaronis* is presumably an upland, if not a definitely alpine, species. In a recent paper (Hutchinson, *in press*) I have discussed the discovery by Mr. J. Omer-Cooper and Dr. H. Scott of two Corixids of undoubted Palæarctic affinities occurring in the Abyssinian highlands at an altitude of about 8000 feet. *Corixa mirandella* now provides another case of an isolated species of a Palæarctic group occurring in Central Africa. Though not an Alpine species, it occurred in or near the most elevated lake in the Rift Valley at an altitude considerably above that of the better-known localities around Lake Victoria.

There are, then, in the north-eastern half of the Ethiopian Region four species of Corixinæ of unquestionable Palæarctic affinities. All are probably found only in the higher country, two, if not three, at considerable elevations. *S.* (*S.*) *kilimandjaronis* and *Corixa mirandella* are apparently more primitive than their northern allies. In discussing the occurrence of species of Palæarctic affinities in Abyssinia (Hutchinson, *loc. cit.*) it was suggested that these insects would have reached their present habitats more easily at a time when a cooler damper climate existed in Central and Northern Africa than occurs to-day. The same suggestion may now be extended to account for the presence of *Sigara* (*S.*) *kilimandjaronis* and *Corixa mirandella*. During the Pleistocene period the climate of East Central Africa underwent considerable changes, and several pluvial periods have been distinguished, probably to be correlated with periods of maximum glaciation in the north. According to Gregory (1921) the level of Lake Naivasha was 150 feet above the present level at one time, and the glaciers on the high Central African mountains formerly extended several thousands of feet lower than they do to-day. It is noteworthy that there is palæobotanical evidence of the existence in Egypt at this time of organisms now not known south of the Mediterranean (Hume & Craig, 1911). The conditions then prevalent would be favourable for the southward invasion of palæarctic forms into Central Africa, and it seems not unreasonable to suppose that as the climate became warmer again such species would tend to survive in the more elevated parts of the country. Such species may be designated as *pluvial relicts*, being strictly comparable with the *glacial relicts* of the European limnologists.

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* If this genus is to be accepted it must be on the understanding that it is almost certainly polyphyletic.

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VII.—*Note on the Occurrence of* Ascaris columnaris, *Leidy, in Siberian* Mustelidæ. By J. S. WILKIE, B.Sc.

(From the Department of Zoology, British Museum (Natural History).)

PROFESSOR O. FUHRMANN, of Neuchâtel, recently forwarded to Dr. H. A. Baylis for determination a small collection of parasitic Nematodes received by him from the Pflänzenschutz-station, Novosibirsk, Siberia. These were handed over to me for investigation. Among them were found several examples of an Ascarid which appears to be identical with *Ascaris columnaris*, Leidy, 1857. These came from the alimentary canal of three species of Mustelidæ, viz., the weasel (*Mustela nivalis*), the stoat (*M. erminea*), and the Siberian polecat (*Putorius eversmanni*).

Ascaris columnaris appears hitherto to have been recorded only from North American skunks (*Mephitis mephitis*). Apart from the descriptions of Leidy (1851 and 1857) the only existing original account of the species seems to be that of Goodey and Cameron (1923). These authors have given good figures of the lips and of the caudal ends of the male and female worms. Their material came from a British skunk-farm.

Fig. 1.

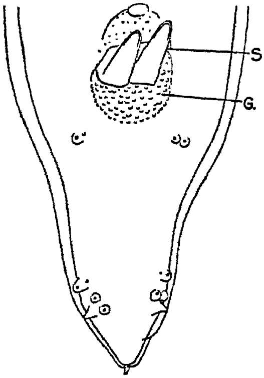

Fig. 2.

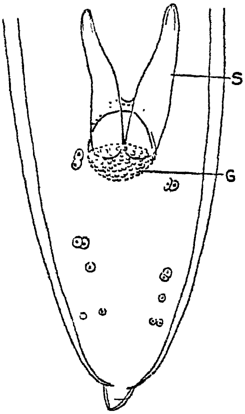

Fig. 1.—*Ascaris columnaris* from *Putorius eversmanni.* Tail of male, ventral view.

Fig. 2.—*Ascaris columnaris* from *Mustela nivalis.* Tail of male, ventral view.

S = spicules; G = granular area.

In the Siberian material certain slight variations have been observed in the arrangement of the caudal papillæ of the male (figs. 1–3). British Museum material from a Canadian skunk has also been examined and compared. The animal from which these specimens came had been in captivity in England. The posterior extremity of a male from this source is shown in fig. 4. The Siberian specimens resemble *A. columnaris*, as described by Goodey and Cameron, rather more closely than do those from the skunk in the British

Museum collection. In the latter, the granular area immediately surrounding the anus is less conspicuous than in the two former, while the tail of the male is only 0·3 mm. long, as against 0·4 mm. in the other specimens. The median preanal papilla, though apparently a constant feature in all the specimens examined, is usually much less conspicuous than is indicated in the figure of Goodey and Cameron.

Fig. 3.

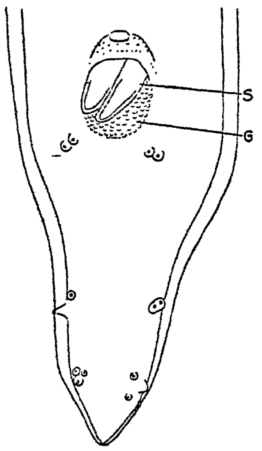

Fig. 4.

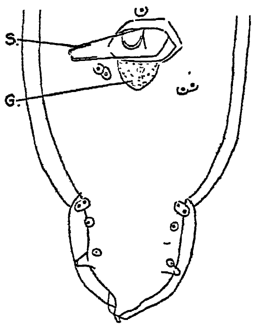

Fig. 3.—*Ascaris columnaris* from *Putorius eversmanni.* Tail of male, ventral view.

Fig. 4.—*Ascaris columnaris* from *Mephitis mephitis.* Tail of male, ventral view.

S=spicules; G=granular area.

In length of spicules, relative length of œsophagus, and width of head the Siberian specimens resemble those from skunks, and a specific or varietal distinction does not appear to be justified.

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VIII.—*Notice of Extension of Range and of new Species of various Invertebrates.* By G. E. MacGinitie, Assist.-Prof. of Zoology, Hopkins Marine Station of Stanford University.

As a result of ecological investigations carried on at Elkhorn Slough, a salt-water inlet of Monterey Bay, California, the ranges of the following animals were extended :—

Phylloplysia taylori, Dall.—This species has previously been known only from Nanaimo, B.C.

Navanax inermis (Cooper).—Not previously reported north of San Diego or Santa Catalina.

Sanguinolaria nuttallii, Conrad.—Not previously reported north of San Pedro.

Betæus longidactylus, Lockington. — Not previously reported north of San Pedro.

Cancer anthonyi, Rathbun.—Not previously reported from north of Long Beach.

Pinnixa faba, Dana.—Not previously reported south of Humboldt Bay. (Holmes reported one in the cloaca of a large Holothurian at San Pedro, but Miss Rathbun thought it was another species.)

Pinnixa franciscana, Rathbun.—Previously known only from San Francisco Bay. Males with chelipeds not previously found.

Pinnixa schmitti, Rathbun.—Not previously reported from south of San Francisco Bay.

Pinnixa tomentosa, Lockington.—Not prevously reported north of San Clemente Island, California.

During this investigation sixteen new species were discovered (not including annelids), the following of which have been named :—

Stylochoplana heathi, Boone (Turbellarian).
Dendrostoma perimeces, Fisher (Sipunculoid).
Urechis caupo, Fisher & MacGinitie (Echiuroid).
Harmothöe adventor, Skogsberg (Polynoid).
Argulus melanostictus, Wilson (Copepod).

The writer would like to call attention to the need for taxanomic work on the marine animals of this region, especially the cœlenterates and annelids.

Pacific Grove, California.
Dec. 12, 1929.

IX.—*A short Review of the Fishes of the Family* Cyclopteridæ. By Dr. A. M. Popov *.

The fishes of the family Cyclopteridæ, in spite of their interesting habits and geographical distribution, have been very unsatisfactorily studied. Up to the year 1892, when Garman's † monograph was published, only five genera were known, containing seven species. Nowadays, thanks to the work of American (Gilbert, Burke, Fowler, and others) and Russian investigators (P. Schmidt, A. Popov, and others) we have eight genera, containing about 23 species. The distribution of these fishes in the high latitudes of the Polar Seas, or in the extreme northern parts of the Atlantic and Pacific, makes a more complete study of the group a matter of difficulty. It is evident, however, that a number of forms new to science will sooner or later be discovered.

Family **Cyclopteridæ.**

Body short, compressed on the sides or broad anteriorly and compressed posteriorly, with a rather large head and lateral eyes. Mouth terminal. Teeth small, in several rows in both jaws. $3\frac{1}{2}$ gills ; gill-openings very small, situated above the pectoral fin. One or two dorsal fins ; both short ; second situated above the anal. Pelvic fins modified to form a kind of sucking disc. Body smooth, without scales, sometimes covered with skinny processes or conical bony tubercles ; these tubercles are sometimes arranged in regular rows, but may be without any visible order. Lateral pores present or absent.

Arctic fishes of Polar seas and northern parts of Atlantic and Pacific Oceans.

Nine genera.

Synopsis of the Genera.

I. Skin armed with bony (or cartilaginous) tubercles or plates.
  A. Tubercles (when well developed) conical.
    1. No pores on lateral line ; first dorsal fin completely enveloped by the skin of the body, represented in the adult by a long crest covered with tubercles ; tubercles arranged in regular rows .... 1. *Cyclopterus.*

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[*] Revised for publication by J. R. Norman, Dept. of Zoology, British Museum (Nat. Hist.).

[†] Mem. Mus. Comp. Zoöl. xiv. (1892).

2. Lateral line pores clearly visible; first dorsal fin free (in which case the tubercles are in regular rows), or, if enveloped by skin of body, is not represented by a longitudinal crest, but by a fleshy triangular projection (in which case the tubercles are irregularly arranged).

a. Tubercles well developed on all parts of the body; bases of second dorsal and anal fins not enveloped by skin of body; first dorsal fin free, or enveloped by skin and muscles (in which case the tubercles are irregularly arranged) .... 2. *Eumicrotremus.*

b. Tubercles weakly developed, but present on all parts of body; base of second dorsal and of anal fin, as well as that of first dorsal, enveloped by skin of body; tubular, barbel-like processes on chin; mouth small .... 3. *Cyclopteroides.*

c. Tubercles weakly developed, sometimes represented by cartilaginous structures present only on anterior part of body (the head and part of the tail naked); first dorsal fin only slightly covered by skin, the rays being visible; no barbels on chin .... 4. *Cyclopteropsis.*

B. Body armed with prickles hidden in the skin and borne on rounded plates; first dorsal fin free .... 5. *Cyclopterocottus.*

II. Skin quite naked or covered with membranous processes.

A. First dorsal fin present.

1. Pores of lateral line present; first dorsal fin enveloped by skin and muscles of body .... 6. *Cyclopsis.*

2. Pores of lateral line absent; first dorsal fin free .... 7. *Lethotremus.*

B. First dorsal fin absent, or so deeply enveloped by the skin that it scarcely projects above the surface of the body.

1. No bony tubercles on body .... 8. *Cyclopterichthy*

2. Body with bony tubercles .... 9. *Liparops.*

1. CYCLOPTERUS.

Linnæus, Syst. Nat. ed. 10, 1758, p. 260.

Cyclopterus lumpus, Linn.

North Atlantic; Baltic, White, and Barents Seas.

2. EUMICROTREMUS.

Gill, Proc. Acad. Nat. Sci. Philad. 1864, p. 190.

Lateral line pores clearly visible. No longitudinal dorsal crest. Body stout anteriorly, compressed posteriorly.

Six species and one subspecies.

Northern parts of Atlantic and Pacific ; Polar Seas.

Eumicrotremus spinosus (Müller).

Cyclopterus spinosus, Müller, Prodrom. Zool. Dan. ix. (1776).

Tubercles on body in regular rows. First dorsal fin quite free. A single pair of tubercles between first and second dorsal. No tubercles on chin, but membranous folds (often notched). Anal openings situated far from edge of sucker.

Northern part of Atlantic ; Barents and Kara Seas.

Eumicrotremus orbis (Günther).

Cyclopterus orbis, Günther, Cat. Fish. iii. 1861, p. 158.

Large conical tubercles on body in somewhat regular rows. First dorsal fin free. Two pairs of tubercles between first and second dorsal. Tubercles present on chin, but membranous folds absent. Anal opening often bordered by folds of skin, situated close to posterior edge of sucker. Tubular, barbel-like processes present on chin.

Northern part of Pacific ; Bering Sea ; Sea of Okhotsk ; northern part of Japanese Sea.

Eumicrotremus pacificus, Schmidt.

Pisces Mar. Orient. (1904).

Body covered with conical tubercles arranged in regular rows. First dorsal fin enveloped by the skin at its base, curved in the form of a sickle, reaching second dorsal when laid back. Chin and base of pectoral naked. 4 to 6 rows of tubercles commencing at interorbital space.

Northern part of Pacific ; Bering Sea ; Sea of Okhotsk ; northern part of Japanese Sea.

Eumicrotremus derjugini, Popov.

Works Len. Soc. Naturalists, lvi. (1926).

Body covered with very small, conical tubercles, irregularly arranged. Four rows of tubercles commencing on head. First dorsal fin entirely enveloped by skin and muscles of body, appearing as a fleshy projection. Chin and often base of pectoral naked. Sucker small.

Polar Seas; Barents, Kara, and Nordenskiold Seas. Replaced in Sea of Okhotsk by the subspecies *E. derjugini okhotensis*.

Eumicrotremus birulai, Povov.

Works Sci. Indust. Stat. Pacific (1928).

Body covered with small conical tubercles, irregularly arranged. 6 rows of tubercles commencing at interorbital space. Chin and base of pectoral fin well covered with small tubercles. First dorsal fin very small and low, enveloped at its base by the skin of the body (the fin just visible on the surface of the back). Snout blunt.

Northern part of Pacific; Sea of Okhotsk.

Eumicrotremus soldatovi, Popov.

Ann. Mus. Zool. Acad. Sci. (1929).

Body stout anteriorly, compressed posteriorly. Head about as broad as high, length 3½ in total length of body. Eye large, diameter about 1½ in interorbital space, which is convex and less than width of mouth. Lips not thick, the breath of upper lip about ⅓ diameter of eye. First dorsal fin enveloped by skin at its base, but upper parts of rays free, without membrane; fin curved in the form of a sickle; base narrow, less than height of fin. Second dorsal slightly enveloped by skin. Head and body entirely armed with high, pointed, conical tubercles arranged in regular rows. Interorbital space concave, without tubercles. One row of tubercles on either side commencing from the upper margin of the eye. Two pointed tubercles in front of first dorsal. The space between first and second dorsal flat, and bordered by three tubercles on either side; ventral surface bordered by three rows of high pointed tubercles, but the space surrounding the anal is flat. Sucker large, diameter equal to width of mouth.

Sea of Okhotsk.

3. CYCLOPTEROIDES.

Garman, Mem. Mus. Comp. Zoöl. xiv. (1892).

Cyclopteroides gyrinops, Garman.

T. c. p. 27.

Alaska.

4. CYCLOPTEROPSIS.

Soldatov & Popov, Rep. Acad. Sci. (1929).

Body somewhat compressed, with the general shape of that of the Cottidæ. Head large, broad, rounded or compressed. Skin armed with slender conical tubercles, the basal parts of which are mostly covered by skin, or with spines which project somewhat from the surface of the body. Tubercles or spines concentrated on sides of anterior part of body, absent on head, abdomen, and caudal peduncle, or sometimes a few spines on upper part of latter. Interorbital space broad, naked, much less than width of mouth. Mouth large, with fleshy lips; lower jaw projecting; teeth in jaws only. Gill-opening small, upwardly directed. A series of tubular pores along the median dorsal line of the body and on the head. Two dorsal fins; the first large, shaped like a parallelogram, the rays visible through the skin which covers them; bases of first and second dorsal fins, and of anal fin smooth. No barbels on chin. Disc of sucker large and projecting somewhat anteriorly.

Six species, two of which are referred provisionally to this genus.

Cyclopteropsis macalpini (Parr).

Cyclopteroides macalpini, Parr, Bergens Mus. Aarb. (1924–5).

Sides of body compressed. Tubercles confined to anterior part of body. First dorsal fin very high, much bigger than second. Mouth large. Interorbital space broad, smooth.

Northern part of Atlantic.

Cyclopteropsis bergii, Popov.

Ann. Zool. Mus. Acad. Sci. (1929).

Body stout anteriorly, compressed posteriorly; head large, a little more than $\frac{1}{3}$ length of body. Mouth very large, width about $\frac{2}{3}$ length of head and $1\frac{1}{2}$ times that of interorbital space; width of lips a little more than $\frac{1}{2}$ diameter of eye. Anterior nostrils larger than posterior. Longitudinal diameter of sucker almost equal to width of mouth or a little smaller. First dorsal fin well developed, shaped like a parallelogram; parts of the rays can be seen through the enveloping skin of body, which is more or less confined to the base of the fin. A few cartilaginous or bony tubercles developed on anterior part of body only.

Sea of Okhotsk.

Cyclopteropsis popovi, Soldatov.

Fishes White, Kara, and Barzov Seas (1923).

Body strongly compressed on sides. Conical tubercles absent. Lower jaw projecting.
Sea of Okhotsk.

Cyclopteropsis jordani, Soldatov.

Fishes Barents, White, and Kara Seas (1929).

Kara Sea.

Cyclopteropsis phrynoides (Gilbert & Burke).

Eumicrotremus phrynoides, Gilbert & Burke, Bull. U.S. Bur. Fish. xxx. (1912).

Body with hidden membranous processes, but without conical tubercles. First dorsal fin enveloped by skin at its base.
Bering Sea.

Cyclopteropsis pavlencovi, Soldatov.

Fish Sea of Okhotsk (1929).

Sea of Okhotsk.

5. CYCLOPTEROCOTTUS, gen. nov.

Body compressed on sides, covered with prickles hidden in the skin and borne on rounded plates. First dorsal fin free. No conical bony tubercles.
Two species.

Cyclopterocottus brashnicowi (Schmidt).

Eumicrotremus brashnikowi, Schmidt, Pisces Mar. Orient. (1904).

Sea of Okhotsk.

Cyclopterocottus phrynoides (Gilbert & Burke).

Eumicrotremus phrynoides, Gilbert & Burke, Bull. U.S. Bur. Fish. xxx. (1912).

Bering Sea.

6. CYCLOPSIS.

Popov, Ann. Mus. Acad. Sci. (1929).

Body oval, slightly compressed on sides, highest opposite first dorsal fiin. Skin entirely naked, or covered with small membranous tentacles, sometimes distributed over the protuberances of the skin. First dorsal fin entirely enveloped by the skin and muscles of the body, appearing as a fleshy projection with the fin-rays invisible. Second dorsal quite smooth, not enveloped by the skin. Distinct pores are present on the sides of the head below the eye, and along the region of the lateral line.

A single species.

Cyclopsis tentacularis, Popov.

Ibid.

Body oval, broad in the middle of its length or slightly compressed on sides. Skin naked, smooth or with some protuberances and with numerous small thin tentacles over its surface. First dorsal fin almost triangular, entirely enveloped by skin, the rays quite invisible. Eye small, diameter about 4½ in length of head. Lips not thick. Anterior nostrils larger than posterior. Sucker large.

Sea of Okhotsk.

7. LETHOTREMUS.

Gilbert, Rept. U.S. Fish. Comm. 1893 (1896).

Body naked. First dorsal fin free, not enveloped by skin of body. No pores in lateral line.

Several species have been described by American authors, based on young specimens. Alb. Parr* regards most of these as pertaining to the genus *Cyclopteroides*, a conclusion which may be regarded as too hasty.

Lethotremus muticus, Gilbert.

Rept. U.S. Fish. Comm. 1893 (1896).

Bering Sea.

Lethotremus vinolentus, Jordan & Starks.

Proc. Calif. Acad. Sci. (1896).

Puget Sound.

Lethotremus armouri, Fowler.

Proc. Acad. N.S. Philad. lxvi. (1914).

Greenland.

Lethotremus awæ, Jordan & Snyder.

Proc. U.S. Nat. Mus. xxiv. (1902).

Japan.

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* Bergens Mus. Aarb. (1924–5).

Lethotremus macalpini, Fowler.

Proc. Acad. N.S. Philad. lxvi. (1914).

Greenland.

8. CYCLOPTERICHTHYS.

Steindachner, Ichthyol. Beiträge, x. (1881).

Body naked, without tubercles or membranous processes. First dorsal fin deeply enveloped by the skin of the body; second dorsal inserted far back, enveloped by the skin at its base. Head large. Teeth in five series.

Cyclopterichthys ventricosus (Pallas).

Cyclopterus ventricosus, Pallas, Spicil. Zool. (1769).

Northern part of Pacific; coasts of Kamtchatka; Sea of Okhotsk.

Cyclopterichthys amissus, Vaillant.

Miss. Sci. Cape Horn, Poiss. (1888).

Straits of Magellan.

9. LIPAROPS.

Garman, Mem. Mus. Comp. Zoöl. xiv. (1892).

Liparops stelleri (Pallas).

Cyclopterus stelleri, Pallas, Zoogr. Ross.-As. iii. (1831).

Northern part of Pacific; coasts of Aleutian Islands, Kamtchatka, etc.

X.—*On* Farzandia, *a new Genus of Acanthocephalid Worms, from the Intestine of* Ophiocephalus marulius. By GOBIND SINGH THAPAR, M.Sc., Ph.D. (London), Reader in Zoology, The University of Lucknow, India.

THE writer in 1927 described a new genus of Acanthocephala, which he named *Acanthogyrus*, from the intestine of *Labeo rohita*, and at the same time advanced a new classification of the class, based on the nature of the proboscis hooks and the body spines. Since then a certain amount of work has been done on the group in the East. Subramanian (1927 *a*) described a new genus *Cleaveius* from Rangoon, while Van Cleave (1928 *a*) described new genera and species from Chinese fishes, and (1928 *b*) gave an account of two new genera and species of Acanthocephala forwarded to him from the collection of the Indian Museum. Recently the writer received from one of his pupils two bottles containing a large number of Acanthocephala from the intestines of *Ophiocephalus marulius*; both the collections were in an excellent state of preservation and all the characters were thoroughly studied. The results of these investigations suggest the creation for these forms of a new genus, named after the donor of the specimens, Farzand Ali. It may be mentioned here that the characters of this new genus, as well as of those described by Van Cleave (1928) and Subramanian (1927), further strengthen the writer's convictions in the validity of the classification advanced in his previous communication.

Farzandia ophiocephali, gen. et sp. n.

The body is elongated and cylindrical, and is slightly narrowed just behind the proboscis to form a short neck in both the sexes. The males are smaller than the females and vary in length from 5·5 to 6 mm., having a breadth of ·32 mm. The females are, however, much longer, 9–10 mm., and have a maximum breadth of ·5 mm.

The proboscis is short and globular like that of the genus *Acanthogyrus*, and was found in most cases in a more or less expanded condition. When fully expanded it measures ·18 mm. in length, and bears, as in *Neosentis*, Van Cleave, 1828, four circles of eight hooks each, deeply implanted in the proboscis-wall by a single root. The lengths of the protruded portions of the hooks in the four rows are as follows:—anterior row, 110 μ; second row, 50 μ; third row, 40 μ; and the fourth or posterior row, 30 μ. The exact shape of the hooks in these rows is shown in fig. 2. The proboscis sheath and receptacle is an elongated sac-like structure ·72 mm. long, whose wall is composed of a single muscular layer.

The proboscis is joined on to the body by a narrow necklike structure, which is smooth and devoid of any spiny outgrowths. This is followed by a region with a conspicuous increase in diameter. This is the body, covered over with conical spines 25 μ long. The arrangement of the spines over the body is very peculiar and recalls that of the genus *Pallisentis*, Van Cleave, 1928. They are arranged in regular circles, in two distinct series. In the anterior region the circles, 11 in number, are more closely set, about 30–40 μ apart. Behind this the rings of spines are more widely spaced, the consecutive circles being about 100 μ apart. This arrangement extends to the posterior end, and thus differs from that of *Pallisentis*, where the spines are absent at the hinder end of the body. In a few cases it was found that some of the spines, particularly at the posterior end of the body, have fallen off, thereby causing an interruption in the regularity and completeness of the circles.

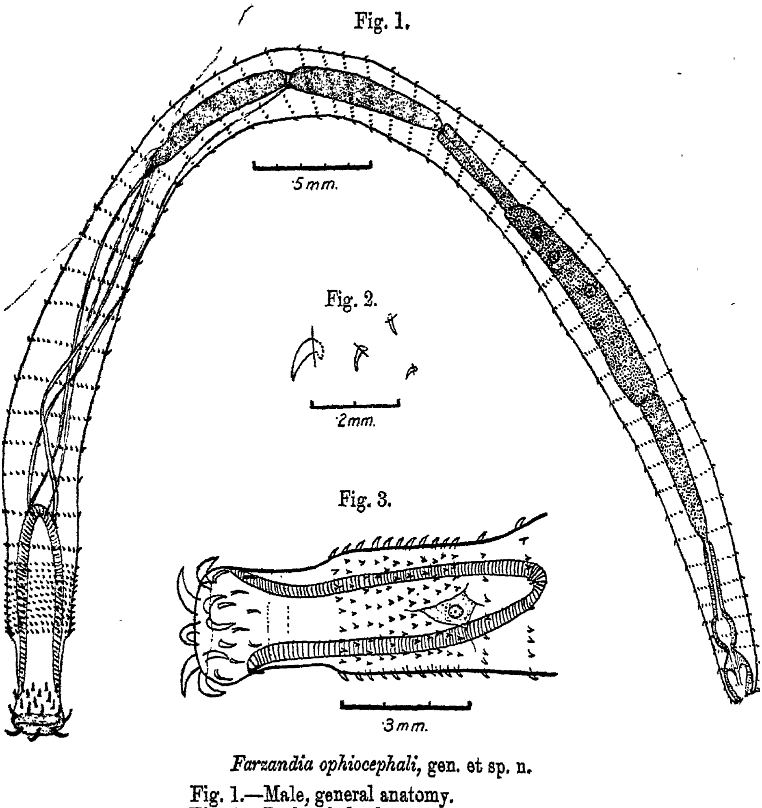

Fig. 1.

Fig. 2.

Fig. 3.

Farzandia ophiocephali, gen. et sp. n.

Fig. 1.—Male, general anatomy.
Fig. 2.—Proboscis-hooks.
Fig. 3.—Proboscis and anterior end of male.

There are two narrow elongated lemnisci projecting into the body-cavity; these are cylindrical structures extending to the testis in the male and to about the end of the anterior third of the body in the female. The brain is a large conical mass situated at about ·6 mm. from the anterior end; posteriorly it is limited by the last ring of the close-set mantle of body-spines.

The genital organs in the male are situated in the posterior two-thirds of the body. There are two elongated testes lying one behind the other and almost equal in size—about ·65 mm. in length. Each has its own duct connecting it to a very long cylindrical dense cement-gland (prostate gland) of a syncytial nature, with a few (5–8) large and prominent nuclei scattered throughout its length. This is followed by an elongated ductus ejaculatorius, terminating in a large protrusible bursa. No trace of a penis is to be observed.

The female genital system has the usual arrangement of parts, consisting of an ovary, a uterine bell, a uterus, an ovejector, and a vagina. The vagina is long and fairly wide. The eggs and embryos float about in the body-cavity, whence they escape through the uterine bell. The embryos are seen within the body-cavity at different developmental stages; they measure ·01 mm. by ·03 mm.

The genus *Farzandia* is thus characterized by the following features:—

1. Presence of four alternate circles of hooks on the globular proboscis.
2. An unarmed elongated neck.
3. Cuticular spines extending over the entire body and arranged in two distinct series, (*a*) an anterior mantle of 11 close-set circles, and (*b*) more widely spaced circles over the rest of the body.
4. Long cylindrical lemnisci.
5. Syncytial character of the prostate glands.

DISCUSSION.

The genus *Farzandia* is interesting as showing a remarkable combination of characters exhibited by several genera of Acanthocephala recently described from India and the Far East. Thus, in having only four circles of proboscis-hooks, a single muscular layer in the proboscis-wall, and syncytial prostate glands, the genus resembles *Pallisentis*, Van Cleave, 1928, but differs from the latter in the number of hooks in each circle and the arrangement of the body-spines over the entire body. In the possession of four circles of eight hooks on the proboscis, it resembles the genus *Neosentis*, Van Cleave, 1928, but differs from it in the presence of a distinct neck and the arrangement of the body-spines in two distinct series. In certain characters *Farzandia* shows its affinities with *Cleaveius* and *Eosentis*, while in others it resembles *Quadrigyrus*. The proboscis is globular in all these genera and the prostate glands are syncytial. These points indicate that these genera possess a natural affinity, and therefore should be included together in a single family or order. In our older classifications, we know that new families have been created for several of these genera, and in some cases for a single genus, with, as a result, a multiplicity of families and considerable inconvenience to a systematic worker. After a careful study of the different genera of Acanthocephala the writer (1927) came to the conclusion that a classification based on the characters and nature of the proboscis-hooks and body-spines would be both natural and would include all the then-known genera. The recently described genera can also be included in such a system ; it can, therefore, stand the usual tests, and claims acceptance.

Van Cleave (1928) has again laid stress on the characters of the nuclei in the subcuticula of Acanthocephala and has reasserted the claims of this character in the classification of the group. It is, however, surprising to find that Van Cleave (1928) erects his new families Pallisentidæ and Hebesomidæ on characters similar to those indicated by the writer in his previous communication (1927). This both lends further support to the system there put forward, and indicates the unsatisfactory nature of the other systems. All the known and recognized genera of Acanthocephala can adequately be included in our new classification based on the presence or absence of the body-spines and the presence of one or two roots of the proboscis-hooks, the other features giving the diagnosis of genera and species. It is urged, therefore, that it should be accepted in preference to other systems, which the writer holds to be artificial and hence unreliable.

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XI.—*Harpacticoid Copepoda from Bermuda.*—Part I. By ARTHUR WILLEY, F.R.S., Strathcona Professor of Zoology, McGill University, Montreal, Canada. (Contributions from the Bermuda Biological Station for Research, No. 160.)

[Plate V.]

INTRODUCTION.

The isolated position of Bermuda in the North Atlantic Ocean, coupled with the reports which have been published from time to time upon the fauna of the group and the surrounding deep sea, has rendered it a geographical centre of the first class, whose importance has perhaps grown in consequence of the displacement theory of Wegener. The Harpacticoid Copepods are so bound up with the shoreline that they seem to form an integral portion of the place, and it was with the desire of recording some observations on these Microcrustacea that I applied to Dr. E. L. Mark, Emeritus Professor of Zoology at Harvard University, for permission to occupy a table during the summer of 1928 at the Bermuda Biological Station for Research on Agar's Island, of which he is the Director. I wish to express my grateful acknowledgments to Dr. Mark for his uniform kindness in making the arrangements and in placing his intimate knowledge of the locality at my disposal. I have also to thank Mr. Louis V. Mowbray, Director of the Bermuda Government Aquarium, for the privilege of a couple of trips in his specially equipped power-schooner, the 'Iridio,' whereby an astonishing wealth of plankton was revealed in the offshore waters.

Among the many contributions from the Bermuda Station there is one (the twenty-first) by C. O. Esterly on the Calanoid Copepoda from the Bermuda Islands (1911), but there is no title referring to the Harpacticoids. An excellent standard of comparison has been furnished by the results of the Cambridge Expedition to the Suez Canal in 1924, and several of the index-species established by R. Gurney (1927) reappear in this distant horizon. Noteworthy amongst such species are *Nitocra affinis*, Gurney, *Pseudomesochra parvula*, Gurney, *Laophonte armiger*, Gurney, and *Tisbella timsae*, Gurney. To these may be added *Tisbe ligustica*, Brian. The following table will give a rough idea of the relative abundance of some of these forms, as obtained from an inland salt-water lake known as Mangrove Lake, which I visited on August 17, 1928. The approximate salinity of a sample of the water was found to be 30·7 (kindly determined by Professor N. J. Berrill).

Percentage Count of Harpacticoids from Mangrove Lake, Bermuda.

	Per cent.
Nitocra affinis, Gurney	32
Laophonte armiger, Gurney	30
Tisbella timsae, Gurney	16
Ameira scotti, Sars	5
Amphiascus propinquus, Sars	5
Cletocamptus bermudæ, sp. n.	4
Laophonte echinata, sp. n.	3
Amphiascus normani, Sars	2
Diagoniceps lævis, gen. et sp. n.	1
Psyllocamptus bermudæ, sp. n.	1
Normanella minuta (Boeck)	1

In addition to the above-named species there was a fair sprinkling of Cyclopoids, notably *Cyclopina gracilis*, Claus (with short furca), and *Halicyclops magniceps*, Lilljeborg.

1. *Tisbe gracilis* (T. Scott, 1895). (Figs. 1–3.)

This is one of the larger Harpacticoids at Agar's Island. I obtained it in almost unlimited numbers in submerged bottles baited with fragments of fish and bivalve molluscs. Females ranging from 0·85 to 1·3 mm., males from 0·72 to 0·87 mm. in length. The male furnishes the decisive character in the transformation of the inner seta of the first joint of the second endopod to a strong, sinuous, ciliated spine distinctly notched at the tip, as figured by Sars.

The outer branch of the second antenna agrees with that figured by Scott, namely, two unequal setæ on the proximal joint, one each on the second and third joints, and three at the apex, one of which is short and spiniform. The branches of the mandible-palp are set far apart, as described and figured by Scott. The two apical spines of the inner branch of the first foot are subequal in length, the inner one being faintly penicillate in the female, not obviously so in the male specimens examined. In the fifth foot of the female (fig. 1) the first (innermost) seta of the distal lamella is stouter and only a little shorter than the next one. The fifth foot of the male carries four setæ on its distal lamella and one inside (fig. 2). The rudimentary sixth foot or genital tubercle projects as a lobe (fig. 3).

Lastly, it may be mentioned that in the male the inner seta of the second basal joint of the first foot is a delicate, flexible seta, instead of the straight spine of the female.

This species was first recorded as *Idya gracilis* from the Scottish coast near Granton, and was afterwards found by Sars off the west coast of Norway.

2. *Tisbe ensifera*, Fischer.

Associated with the swarms of *Tisbe gracilis* was a smaller species with a considerable range in length from 0·63 to 0·93 mm. The length of the caudal stylets is seven-eighths of the breadth, and the inner and outer terminal setæ are greatly prolonged. The fourth joint of the anterior antenna is three-fifths the length of the third. The spines at the end of the inner branch of the first foot are unequal, the inner one longer and penicillate. The fifth foot has the five setæ of its distal lamella inserted as shown by Sars in *T. ensifera*, and the fourth (from the inside) is much the shortest.

In the first foot the insertion of the inner seta divides the second joint of the inner branch into proximal and distal portions as 17 to 25, the insertion being relatively more proximad than in *T. gracilis*, where the proportion is 17 to 23.

This species was first recorded from Madeira, and was taken again by Sars off the coast of Norway. The edges of the urosome segments are violaceous after preservation, as also is the fifth foot.

3. *Tisbe bermudensis*, sp. n. (Figs. 4, 5.)

Found among the maskweeds littering the test of the sea-urchin *Arbacia*; it also occurred sparingly in association with *T. gracilis* and *T. ensifera*. Length of female from 0·74 to 0·8 mm. Anterior antenna nine-jointed (fig. 5), fourth joint one-half the length of the third. The proximal joint of the outer branch of the second antenna has one seta. The outer branch of the first foot is normal, the middle joint largest; the second joint of the inner branch is scarcely longer than the first joint; the terminal spines of the inner branch are unequal, but both of them are broadly and profusely penicillate; the inner seta of the second joint of the inner branch is large and has a central insertion. The third outer joint of the fourth foot has a more marked elongation than in the examples of *T. ensifera* from Bermuda, exceeding the length of the first two joints together.

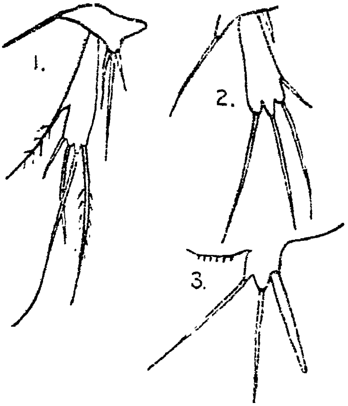
The fifth feet are moderately long, with five long setæ clustered at the summit of the distal lamella (fig. 4). The length of the caudal stylets is one-half their breadth, and the prolongation of the inner and outer caudal setæ equals that in *T. ensifera*.

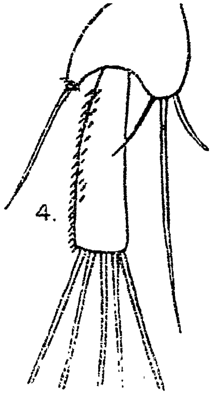
In the male (0·55 mm.) the genital tubercle bears three setæ, of which the innermost is a broad petaloid spine with minutely denticulate edges, scarcely reaching beyond the hinder edge of the second abdominal segment. The anterior antennæ are eight-jointed, the geniculation taking the place of the small intercalary joint of the female; the proportions of the joints are reversed, the third joint being now distinctly shorter than the second (subequal in female), and the fourth joint is one and one-half times the length of the third.

4. *Tisbe ligustica* (Brian). (Fig. 6.)

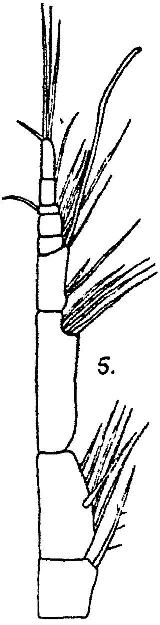
Idya ligustica, Brian, 1920 (Gulf of Genoa).

An ovigerous female from the masking weeds of *Arbacia* measured 0·48 mm. in length and tallies exactly with Brian's





Figs. 1–3.—*Tisbe gracilis* (T. Scott). 1. Fifth foot of female. 2. Fifth foot of male. 3. Sixth foot of male.
Fig. 4.—*Tisbe bermudensis*, sp. n. Fifth foot of female.



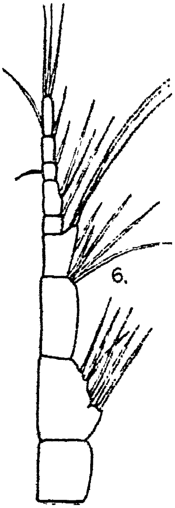


Fig. 5.—*Tisbe bermudensis*, sp. n. Anterior antenna of female.
Fig. 6.—*Tisbe ligustica* (Brian). Anterior antenna of female.

description. It is chiefly characterized by its distinctly nine-jointed first antenna (fig. 6) and by the structure of the first foot. The middle joint of the outer branch of the first foot is very much smaller than the first joint, and the third joint is again much shorter than the second joint, such proportions being unique in the genus; the enlarged first joint of the outer branch is equal to the first joint of the inner branch. The first two joints of the inner branch of the first foot are equal, and the very short third joint of the inner branch carries two unequal terminal uncini, both of which are strongly penicillate, bearing at the end of each a great pennon-shaped vane.

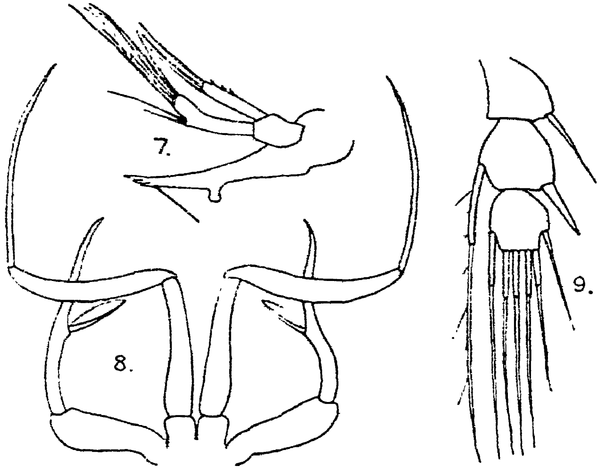
5. *Tisbella timsae*, Gurney. (Figs. 7–9.)

As mentioned above, males and females of this species were obtained in some quantity at Mangrove Lake among algæ and aviculoid mussels. Length of female 0·83 mm., of male 0·59 to 0·62 mm. The first antennæ of the male are eight-jointed, geniculated between the sixth and seventh joints; in the female the sixth and seventh joints are imperfectly divided. The fourth joint of the outer branch of the second antenna is considerably elongated. The branches of the mandible-palp are set close together (fig. 7). The palp of the maxilla is not perceptibly lobulated. The mouth-cone is pro-eminent, neither pair of maxillipeds taking part in its formation; they are large, and the claw of the outer or anterior pair bears a peculiar vaned seta (fig. 8).

The outer branch of the first foot carries on its third joint a total of six setæ, all of which are jointed (fig. 9). The leg-formula, as defined by Gurney, consists in tabulating the inner setæ of the proximal joints and all the setæ of the terminal joint of the three pairs of swimming-feet (p2 to p4) of the female. Considering the distal joint as tipped with two terminal setæ, one may disregard the distinction between flexible bristles and rigid spines, making the table purely numerical.

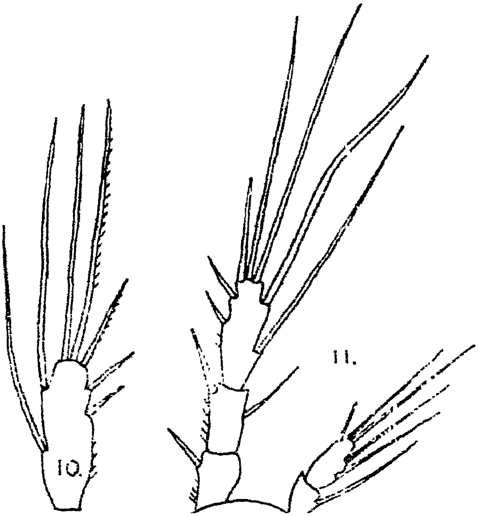
	Endopod.			Exopod.		
p2	1	2	221	1	1	223
p3	1	2	321	1	1	323
p4	1	2	221	1	1	323

Gurney obtained a single female of this well-marked species at Ismailia.



Tisbella timsae, Gurney.

Fig. 7.—Mandible.
Fig. 8.—Anterior and posterior maxillipeds from behind.
Fig. 9.—Outer branch of first foot.



Mesochra pygmæa (Claus).

Fig. 10.—Third joint of third exopod, for insertions of setæ.
Fig. 11.—Fourth foot.

6. *Mesochra pygmæa* (Claus). (Figs. 10, 11.)

From the litter on the spines of *Arbacia*.

Female: 0·325 mm. and 0·355 mm. Colour, as preserved, golden-yellow. Leg-formula :—

	Endopod.		Exopod.		
p2	1	221	0	1	123
p3	1	221	0	1	223
p4	1	221	0	1	223

The inner seta of the first joint of the inner branch of the first foot is subcentral, inserted slightly distad of the middle, dividing this joint into proximal and distal portions in the proportion 6 to 5. In the third joint of the outer branch of the third foot (fig. 10) the level of insertion of the setæ differs somewhat from the Norwegian type. The second or distal inner seta of the third outer joint of the fourth foot is enlarged and curved, about twice the thickness of the proximal inner seta (fig. 11).

The ovisac contained about ten rather large eggs.

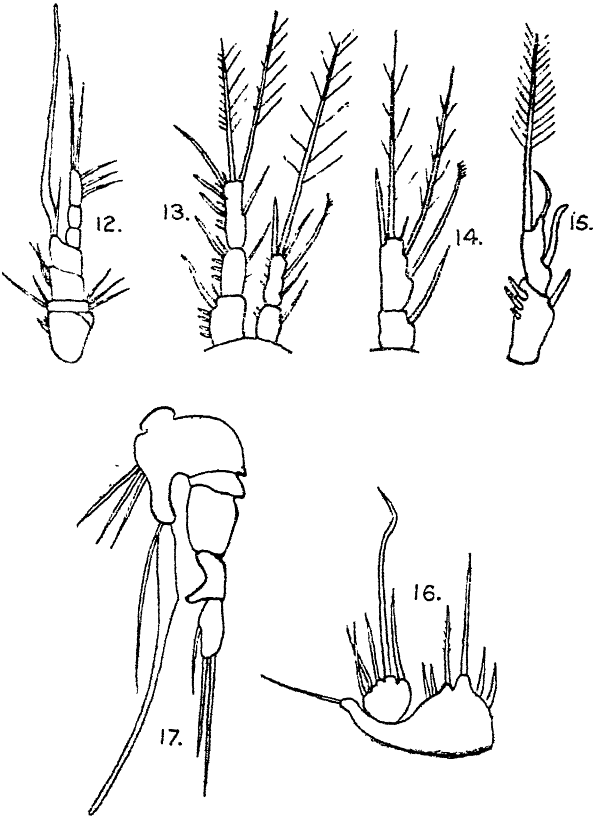
7. *Pseudomesochra parvula*, Gurney. (Figs. 12–17.)

Among intertidal weed attached to roots of mangrove-trees in the southern arm of Fairyland Creek, near Agar's Island, June 21, 1928. Length of male and female 0·44 mm.

In the external appearance one is chiefly struck by the extraordinary versatility of the articulation between the anterior antennæ and the coxal areas of the head, the base of the antenna being strongly constricted. A detached antenna is shown in fig. 12, from which it would appear that the second joint is quite short and not connected with the subglobular first joint by a hinged junction, but by a simple plane. At the inner distal corner of the first joint there is a chitinous thickening. The leg-formula is given by Gurney, the only addition in the Bermuda material being the presence of a distinct vestige of an inner terminal seta on the third endopod (figs. 13 & 14) and a much fainter remnant on the fourth endopod.

A decisive character is furnished by the fifth feet of the female, the inner lamellæ of which bear two conspicuous uncinate processes inside the series of marginal setæ.

In the male (hitherto undescribed) the inner branch of the third foot is transformed as shown in fig. 15. In the fifth foot of the male the uncinate processes of the inner lamella are replaced by two strong spines (fig. 16). The first joint of the anterior antenna is enlarged and serrulated on its inner side; the fourth joint is also enlarged, and there is an extra segment in the distal portion; the seventh segment geniculates upon the sixth (fig. 17).



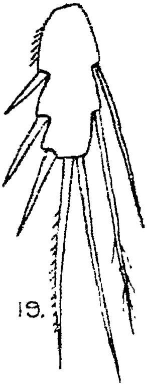
Pseudomesochra parvula, Gurney.

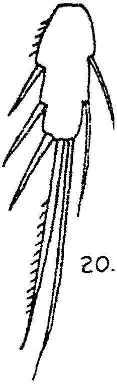
Fig. 12.—Anterior antenna of female.
Fig. 13.—Second foot of female.
Fig. 14.—Endopod of third foot of female.
Fig. 15.—Endopod of third foot of male.
Fig. 16.—Fifth foot of male.
Fig. 17.—Part of anterior antenna of male from fourth joint to end.

In one male the mid-body was dark chocolate-brown, giving crimson reflection, and the middle caudal seta on both sides was twisted, flame-shaped, like a Malay kris. In another, the setæ were not twisted and colour less intense.

8. *Ameira scotti*, Sars. (Figs. 18, 19.)

Mangrove Lake. Females up to 0·59 mm., males 0·40 mm. Of the five setae fringing the distal lamella of the fifth foot, the fourth and fifth (counted from the inside) are subequal, the fifth slanting outwards, the fourth pointing straight backwards. The spinules fringing the ventral border of the second segment of the urosome are interrupted by a wide gap in the female. The fifth foot of the male has two setæ (large and small) on the inner basal lamella, four on the distal lamella, of which the first is a strong spine and the third is rudimentary (fig. 18). The middle caudal seta may exceed the length of the body.





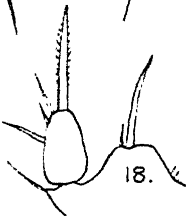


Fig. 18.—*Ameira scotti*, Sars. Fifth foot of male. 19. Third joint of second exopod of female.

Fig. 20.—*Ameira parvula* (Claus). Third joint of second exopod of female.

9. *Ameira parvula* (Claus). (Fig. 20.)

Fairyland Creek. Female 0·40 mm. Segments of the urosome smooth below. The ratios of the two distal joints of the inner branch of the first foot to the proximal joint of the same branch and to the whole of the outer branch are :—

	p1Ri2 & 3.	p1Ri1.	p1Re.
A. scotti	12	32	24
A. parvula	16	20	20

Other differences in the details of the natatory setæ are exemplified in figs. 19 & 20. In *A. parvula* the third and fourth joints of the anterior antenna are subequal; in *A. scotti* the third joint is longer than the fourth.

There is no rudimentary seta on the fourth foot as there is in the variety *tenuiseta* from St. Andrews, New Brunswick (Contrib. Canadian Biol. n.s. vol. iv. no. 33, 1929, p. 537).

10. *Nitocra minor*, sp. n. (Figs. 21–24.)

Fairyland Creek, associated with *Ameira parvula*. In the preserved state there is a purplish tinge on the fifth foot and the furca. Length of female 0·56 mm., of male 0·355 mm. The colour is the first indication of the distinctness of the species, as in other instances among the Harpacticoids. The anterior antenna is shorter than the head, the third and fourth joints subequal. The proportions are:—

$$\frac{1\quad 2\quad 3\quad 4\quad 5\quad 6\quad 7\quad 8}{5\quad 7\quad 4\quad 4\tfrac{1}{2}\quad 3\quad 3\tfrac{1}{2}\quad 3\quad 5}.$$

The shape of the caudal stylet is quadrate. The outer branch of the first foot is equal to the first joint of the inner branch; the second and third joints of the inner branch are equal; there is an inner seta on the second joint of the outer branch. The fifth foot has five setæ on basal and distal lamellæ, the arrangement being closely similar to that figured by Sars for *N. spinipes*. The male differs in having only five setæ on the distal lamella (fig. 21); in *N. spinipes* there is a supernumerary inner seta on the distal lamella of the male fifth foot, bringing the total up to six.

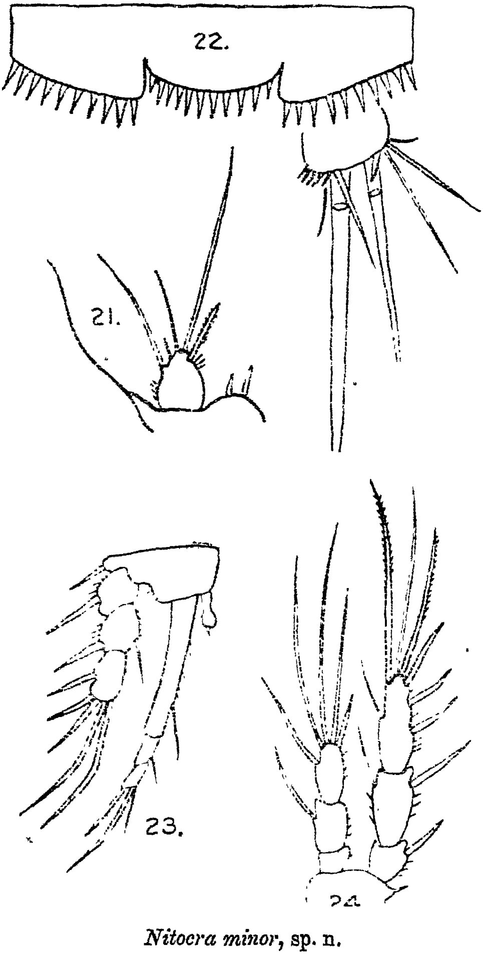
The urosome of the female also resembles that of *N. spinipes*. The fourth and fifth abdominal segments (Ab4 and Ab5) are smooth below, the second and third segments have very small spinules below, larger at the sides. On the dorsal side Ab4 has a complete row of medium-sized spinules, Ab3 a row of much smaller spinules, and Ab5 (anal segment) is armed with large spinules subtending the furca and on the anal operculum (fig. 22).

In the first foot of the male the inner basal spine is modified, club-shaped, somewhat as described by Giesbrecht in *N. typica* from Kiel (fig. 23).

The present species is best characterized by the leg-formula, from which it will be seen that it resembles *N. inuber*, Schmankevitsch, in the absence of an inner seta from the first joint of both branches of the natatory feet.

	Endopod.			Exopod.		
p2............	0	1	121	0	1	223
p3............	0	1	221	0	1	223
p4............	0	1	221	0	1	223

In the natatory feet the distal setæ tend to be crowded at the summits of the branches (fig. 24). The anterior antennæ of the male are modified much as in *N. spinipes,*



Nitocra minor, sp. n.

Fig. 21.—Fifth foot of male.
Fig. 22.—Anal segment and caudal stylet from above.
Fig. 23.—First foot of male.
Fig. 24.—Fourth foot of female.

but the last joint is only imperfectly subdivided by a faint line, and is not at all claw-shaped, bearing at its end a long, rather thick, flexible seta with a delicate setule at its base inside.

The principal character separating *N. minor* from *N. spinipes* is the structure of the first foot, added to the leg-formula as above.

11. *Nitocra affinis*, Gurney.

Abundant in Mangrove Lake; also found associated with *Nitocra minor* in Fairyland Creek. Length of female from 0·51 to 0·63 mm., of male 0·425 mm. The inner of the two long terminal setæ of the very short caudal stylet is about as long as the body. The short narrow rostrum bears at its tip a soft median *filum terminale* in addition to the usual pair of sense-hairs. Otherwise I have nothing to add to Gurney's description of the species beyond the fact of its occurrence at Bermuda. The leg-formula is again characteristic.

	Endopod.			Exopod.		
	1.	2.	3.	1.	2.	3.
p2	1	1	121	0	1	223
p3	1	1	221	0	1	223
p4	1	1	221	0	1	323

The structure of the third joint of the outer branch of the fourth foot recurs in other Harpacticoids, but not in any other species of *Nitocra*. The anal operculum of the female is fringed with about fifteen rather coarse spinules, that of the male with nine.

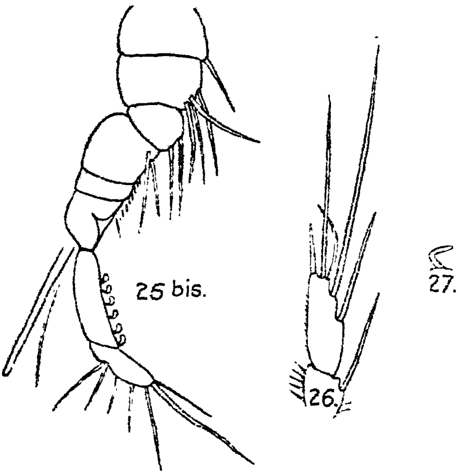
12. *Nitocra lacustris* (Schmankevitsch).
(Pl. V. fig. 25; figs. 25 *bis*–27.)

Pembroke Marsh, Bermuda, associated with mosquito larvæ. An extended ovigerous female measures 0·40 mm., and its outward appearance is much like that of *N. affinis* except for the shorter anterior antennæ. The characteristic structure of the first pair of legs is well brought out in the microphotograph (Pl. V. fig. 25). Schmeil states that the posterior antenna (in the synonym *N. simplex*) is three-jointed, and that the outer branch arises from the second joint. The three-jointed appearance is due to the prominent coxal lobe which carries the shaft of the antenna; the shaft itself is two-jointed, the proximal part not being subdivided, as figured by Richard (under the name *Canthocamptus yahiai*).

The leg-formula is:—

	Endopod.			Exopod.		
p2...........	0	1	111	0	1	223
p3...........	0	1	221	0	1	223
p4...........	0	1	221	0	1	223

The anterior antenna of the male (fig. 25 *bis*) carries on its penultimate joint a series of bean-shaped refringent bodies, recurved. The inner branch of the third foot of the male (fig. 26) shows incipient transformation in the reduction of the inner terminal seta and in the spinulation of the outer border of the third joint. The outer border of the feet is coarsely spinulose throughout, except the third joint of the inner branch of the third foot of the male, which is minutely spinulose. The inner basal spine of the first foot in the male is bent into a pale V-shaped hook (fig. 27). The anal operculum carries seven strong spinules in the male; about nine in the female. The distal lamella of the fifth foot of the male has six setæ in the individual dissected, namely, one large seta near the middle of the inner border, two apical setæ, and three outer setæ ; the outermost or sixth of the series is thick and spiniform, the fifth a little longer but slender.

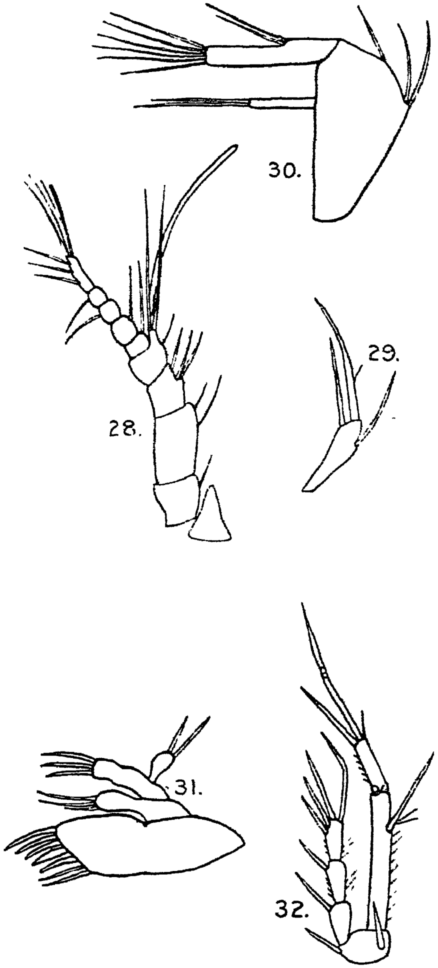


Nitocra lacustris (Schmankevitsch).

Fig. 25 *bis*.—Anterior antenna of male.
Fig. 26.—Last two joints of third endopod of male.
Fig. 27.—Inner basal hook of first foot of male.

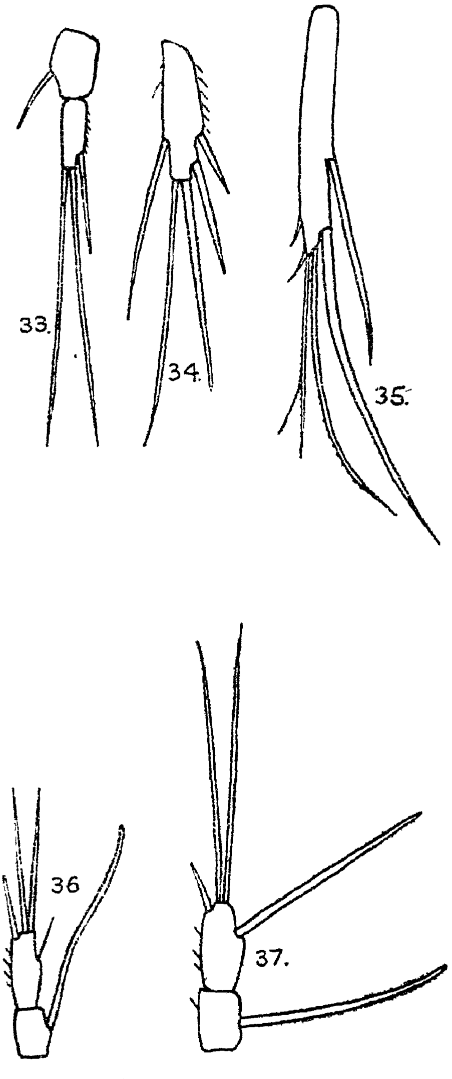
Diagoniceps, gen. nov.

Body smooth and slender ; rostrum small, defined behind; anterior antennæ (fig. 28) nine-jointed, first joint simple; posterior antenna three-jointed, outer branch one-jointed (fig. 29); mandible-palp biramous (fig. 30); maxillary palp with single exopodal lobe (fig. 31); first pair of legs as in *Tetragoniceps*; endopods of natatory legs two-jointed, more or less transformed in the male.



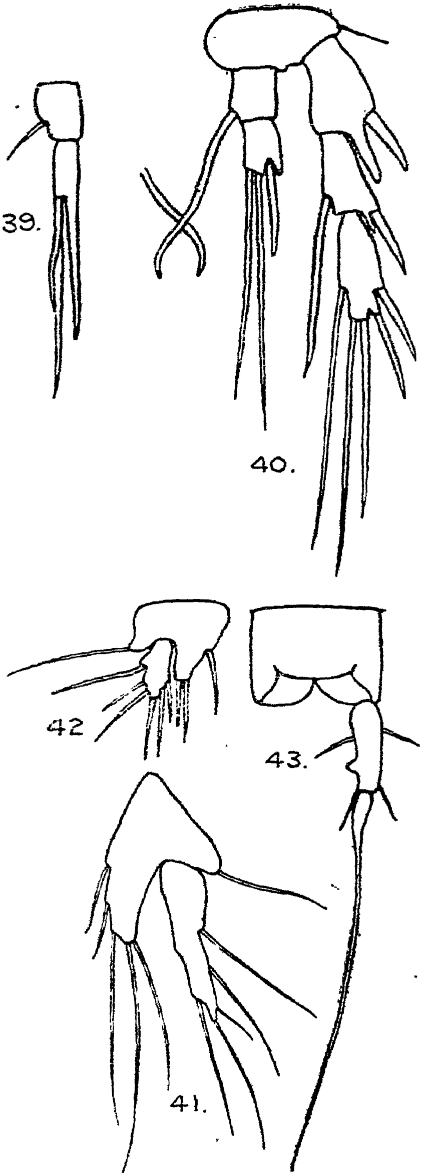
Diagoniceps lævis, sp. n.

Fig. 28.—Anterior antenna and rostrum.
Fig. 29.—Outer branch of posterior antenna.
Fig. 30.—Mandible-palp.
Fig. 31.—Maxilla.
Fig. 32.—First foot of male.



Diagoniceps lævis, sp. n.

Fig. 33.—Endopod of second foot of female.
Fig. 34.—Third joint of exopod of same foot.
Fig. 35.—Third joint of exopod of fourth foot.
Fig. 36.—Fourth endopod of male.
Fig. 37.—Fourth endopod of female.

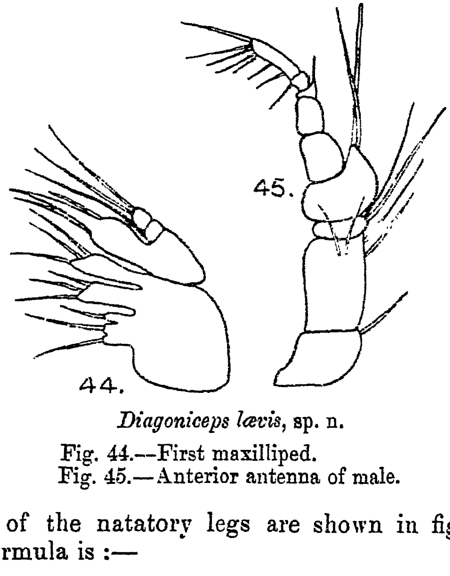


Diagoniceps lævis, sp. n.

Fig. 39.—Second endopod of male.
Fig. 40.—Third foot of male.
Fig. 41.—Fifth foot of female.
Fig. 42.—Fifth foot of male.
Fig. 43.—Anal segment and caudal stylet of female from above.

13. *Diagoniceps lævis*, sp. n.
(Pl. V. fig. 38; figs. 28–37, 39–45.)

Mangrove Lake. Length of female and male about 0·60 mm. Rostrum triangular, not reaching to the end of the first joint of the anterior antenna (fig. 28). First leg (fig. 32) with two-jointed inner and three-jointed outer branch, as in *Tetragoniceps scotti*, Sars, except that the third outer joint is not shorter than the others and the outer edge of the first inner joint is smooth. The articulation between the segments of the inner branch is conspicuously hinged.



Diagoniceps lævis, sp. n.

Fig. 44.—First maxilliped.
Fig. 45.—Anterior antenna of male.

Details of the natatory legs are shown in figs. 33–38. The leg-formula is :—

	Endopod.			Exopod.	
p2..........	1	021	0	1	122
p3..........	1	021	0	1	122
p4..........	1	121	0	1	222

The outer branches of the fourth foot are greatly prolonged in the female (somewhat less so in the male), so that they cross each other in the preparation; the fourth exopod is longer than the third in the proportion 5 : 3, and the fourth exopod of the female is to that of the male as 7 : 5.

In the second endopod of the male the outer seta of the second joint is replaced by a long and slender mucroniform process (fig. 39). In the third foot the endopod is like that of the female Pl. V. fig. 38 except that the outer seta of the second joint is a strong spine set in a deep socket; the outer distal angle of the first joint of the exopod is produced to a thick blunt spur as long as the adjoining spine (fig. 40). In the fourth foot the inner seta of the second joint of the endopod is reduced to a vestige (compare figs. 36 and 37).

The fifth feet are shown in figs. 41 and 42. The caudal stylets are tapering, longer than the anal segment, about four times longer than wide, with a jutting projection inside (fig. 43); in the male they are more slender and smooth.

The first maxilliped (fig. 44) consists of a biarticulate terminal part, a claw-bearing middle part, and a basal part with three inner lobes, the proximal one partly subdivided by a deep notch. The second maxilliped is normal. The first antenna of the male (fig 45) is still nine-jointed, and is transformed in a manner conforming to the generic character. With so many resemblances to *Tetragoniceps*, it seems strange that the antennæ in both sexes should be completely different.

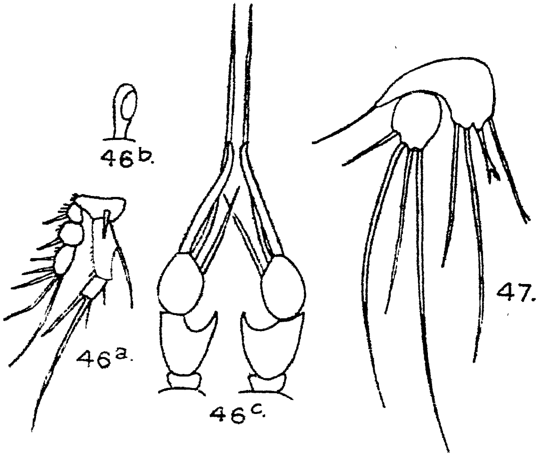
14. *Psyllocamptus bermudæ*, sp. n. (Figs. 46, 47.)

Mangrove Lake. The generic name, due to T. Scott (1899), was misspelt *Phyllocamptus* by Sars. The Bermudan species is closely related to *Psyllocamptus minutus* (Sars) by the structure of its natatory feet, the inner branches of which, though very short, are three-jointed, the middle joint lunulated inside. It differs specifically in the structure of the first and last feet, and also in the caudal stylets, which are quadrate, not longer than broad, and not tapering at the end. The inner branch of the first foot is only a little longer than the outer branch; its proximal joint is twice the length of the distal joint and bears at the centre of its inner border a strong seta; the distal joint has, in addition to its three apical setæ, a small inner seta (fig. 46 *a*). In the fifth foot each lamella carries four setæ (fig. 47). The ovisac is a flattened ellipse with the eggs arranged in one plane.

Up to the present I have only seen one male and one female of this species, the latter 0·425 mm. in length. The leg-formula is the same as in *P. minutus*, namely :—

	Endopod.			Exopod.		
p2..........	0	0	111	0	0	023
p3..........	0	0	111	0	0	023
p4..........	0	0	111	0	0	223

In the male (0·34 mm.) the anterior antenna is eight-jointed (as in the female), geniculated between the sixth and seventh segments, the terminal joint not claw-shaped. The inner basal spine of the first foot is transformed (fig. 46 *b*). In the third foot the outer spines of the inner branches are enlarged and slightly curved at the ends, which come together in the middle line (fig. 46 *c*). In the fifth foot the inner lamella bears three setæ, the distal likewise three setæ; the middle or apical seta of the distal lamella is longest.

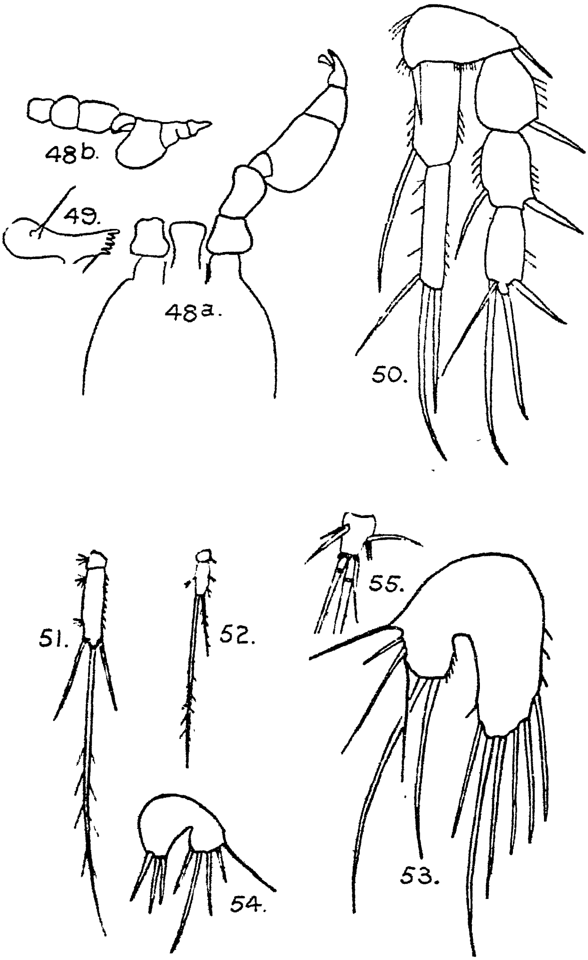


Psyllocamptus bermudæ, sp. n.

Fig. 46 *a*.—First foot (female).
Fig. 46 *b*.—Inner basal spine of male first foot.
Fig. 46 *c*.—Third foot of male.
Fig. 47.—Fifth foot of female.

15. *Cletocamptus bermudæ*, sp. n. (Figs. 48–56.)

Mangrove Lake. Length of female 0·56 to 0·69 mm., of male 0·51 to 0·62 mm. The rostrum is moderately long and defined; anterior antennæ six-jointed (four proximal and two distal joints), the sixth joint rather long. In the male the rostrum is not so clearly defined behind and the fourth joint of the anterior antenna is expanded into a great rounded gibbosity (fig. 48). The posterior antenna is two-jointed, its outer branch small and slender, with a single apical seta and a lateral seta. The mandible-palp is reduced to a single seta arising directly from a well-defined circular



Cletocamptus bermudæ, sp. n.

Fig. 48 *a*.—Male rostrum and anterior antenna from above.
Fig. 48 *b*.—Same antenna from the side.
Fig. 49.—Mandible and its reduced palp.
Fig. 50.—Female first foot.
Fig. 51.—Second endopod of female (the figure number is placed at the inner side of the branch).
Fig. 52.—Fourth endopod of female (the figure number is placed at the inner side of the branch).
Fig. 53.—Fifth foot of female.
Fig. 54.—Fifth foot of male.
Fig. 55.—Left caudal stylet from above.

area in the body of the mandible (fig. 49). The branches of the first foot are equal in length; the outer branch has an inner seta on the middle joint and four setæ at and near the apex of the third joint (fig. 50). The leg-formula is :—

	Endopod.		Exopod.		
p2........	0	111 (fig. 51)	0	1	122
p3........	0	111	0	1	222
p4........	0	020 (fig. 52)	0	1	122

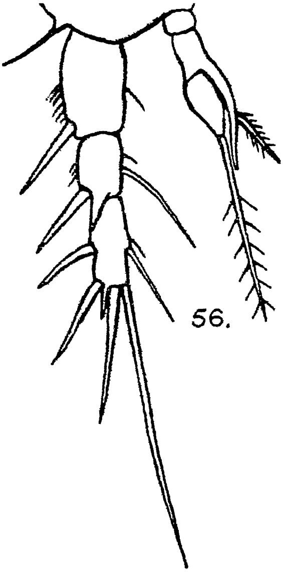
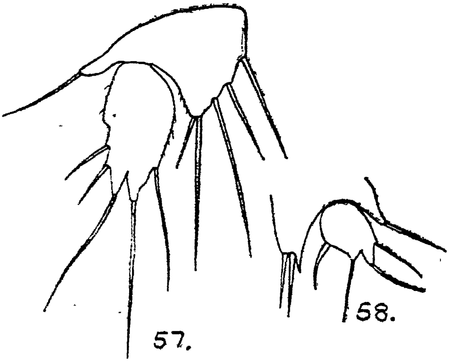


Fig. 56.—*Cletocamptus bermudæ*, sp. n. Third foot of male.

In the fifth foot the basal lamella, with six marginal setæ, is confluent with the distal lamella, which also has a total of six setæ (fig. 53). In the male the inner expansion has three setæ, the distal five in all (fig. 54).

The caudal stylet is longer than broad, as long as the anal segment, with two proximal lateral setæ (fig. 55); it is somewhat more slender in the male, longer in relation to its breadth.

The third endopod of the male is faintly three-jointed; the middle joint is produced inside to a strong mucroniform process; the third joint carries a plumose seta arising distally not far from the long apical seta, though its point of insertion is not seen in the figure (fig. 56). In this figure the outer branch is abnormal and was drawn before the abnormality was discovered; in the normal foot on the other side, as well as in another male on both sides, the third joint of the exopod has six setæ as in the female, but in this abnormal foot the distal inner seta is missing and only the short proximal inner seta remains. In the second foot the short proximal inner seta is the only one present on the inner edge of the third joint of the exopod; in the third joint of the fourth exopod it is the long distal seta which alone is present on the inner border.



Amphiascus propinquus, Sars.
Fig. 57.—Female fifth foot.
Fig. 58.—Male fifth foot (variation).

16. *Amphiascus propinquus*, Sars. (Figs. 57, 58.)

Mangrove Lake. Males and females from 0·37 to 0·48 mm.

The Bermudan representative of this species is not quite identical with the type from the south coast of Norway, but the differences are hardly sufficient to render a new name desirable. The leg-formula is the same, and in each natatory foot the distal inner seta of the outer branch is rudimentary. In the fifth foot of the female the two apical setæ of the distal lamella are separated by a shallow notch in Sars's figure, by a deep notch in fig. 57. In the male the middle joint of the outer branch of the posterior antenna is without a seta, though present in the female. The modified second foot of the male is the same in both, except that in the Bermudan form the single apical seta of the inner branch is much longer, reaching beyond the end of the enlarged outer spine, and is as long as the joint which bears it. In the fifth foot of the male, the rudimentary seta (fourth from inside) is sometimes present, but it may be absent as in fig. 58 (same on both sides); the outer small seta of the inner lamella is represented by a spiniform process.

The leg-formula is as follows:—

	Endopod.			Exopod.		
p2..........	1	2	121	1	1	223
p3..........	1	1	321	1	1	223
p4..........	1	1	221	1	1	323

In the first foot the outer branch is much shorter than the first joint of the inner branch. At the inner border of the second basal joint of the first foot of the male there are three accessory spiniform projections, as in the Norwegian type. This form is doubly linked with the Norway type and with the Oriental *A. angustipes*, Gurney.

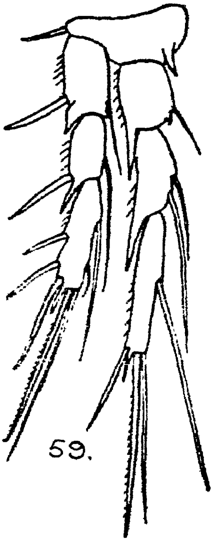
17. *Amphiascus normani*, Sars. (Figs. 59–61.)

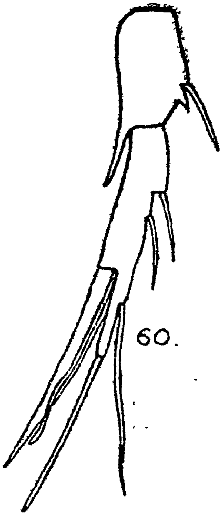
Mangrove Lake. Female 0·65 mm., male 0·59 mm.

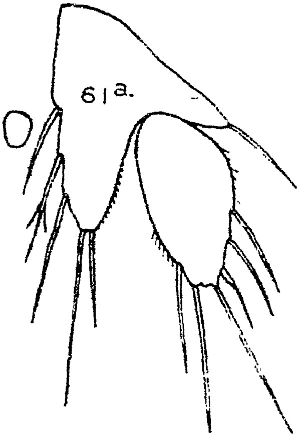
In this species, again, the distal inner seta of the outer branches of the swimming-feet is rudimentary, but the leg-formula differs from that of *A. propinquus*:—

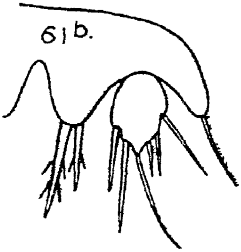
	Endopod.			Exopod.		
p2........	1	2	121	1	1	223 (fig. 59)
p3........	1	1	221	1	1	223
p4........	1	1	121	1	1	323

In the first foot the outer branch is longer than the first joint of the inner branch. In the second foot the inner seta of the third joint of the endopod has a central insertion, as shown in the figure; in the fourth foot the insertion is proximal. In the third foot the interspaces at the inner border of the third joint of the endopod produced by the insertions of the two inner setæ are, from the base of the joint to the apex, as 10 to 6 to 16. In the fourth foot the first inner seta of the third joint of the outer branch is about five-sevenths the length of the enlarged second inner seta. In the fifth foot of the female the fourth seta of the distal lamella (from the inside) is swollen at the base, but the part beyond the swelling is longer than that figured by Sars (fig. 61 *a*). In the male the transformed inner branch of the second foot resembles that in *A. propinquus*, but the proximal joint is mucronate outside and the distal joint is more produced at the apex (fig. 60). The fifth foot of the male has two coarsely spicate spines on the inner lamella and six setæ on the distal lamella, the fourth from the inside being a short straight seta (fig. 61 *b*).









Amphiascus normani, Sars.

Fig. 59.—Female second foot.
Fig. 60.—Second endopod of male.
Fig. 61 *a*.—Female fifth foot.
Fig. 61 *b*.—Male fifth foot.

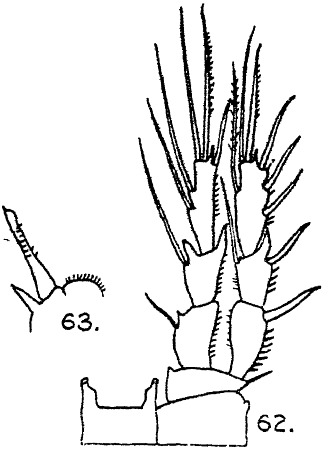
18. *Amphiascus erythræus* (A. Scott, 1902). (Figs. 62, 63.)

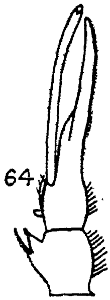
Gurney, 1927, p. 521.
Stenhelia erythræa, Scott, *op. cit.* p. 411.

From *Arbacia* maskweed, associated with *Tisbe bermudensis* etc. Male 0·54 mm., female measurement omitted.

The outer branch of the first foot is shorter than the first joint of the inner branch and is without inner seta. The leg-formula is distinctive, as given by Gurney, making allowance for the slightly different notation employed, as explained above :—

	Endopod.			Exopod.		
p2..........	1	2	121	0	1	123
p3..........	1	1	221	0	1	123
p4..........	1	1	121	0	1	223





Figs. 62, 63.—*Amphiascus erythræus* (A. Scott). 62. Male third foot and interpedal lamella. 63. Inner border of first basipod of male.

Fig. 64.—*Amphiascus robinsoni* (A. Scott). Second endopod of male.

In the second foot the insertion of the inner seta of the third joint of the endopod is subcentral (slightly distad of the middle of the joint) ; in the fourth foot the insertion of the corresponding seta is central, but in the female individual there is an additional distal inner seta near the apex of the third joint, of normal appearance, on the right foot only.

The inner branches of the second pair of feet in the male are transformed to a scissor-shaped complex adequately figured by Gurney. The third foot is slightly transformed in the male; in the middle joint of the endopod the small acumination normally present in front of the inner seta is enlarged to a conspicuous blunt conical process, and the acuminations on the interpedal lamella are transformed to enlarged capitate processes (fig. 62). The inner basal spine of the first foot is enlarged in the male to a powerful rasp-like organ with a spiniform process of the basal lobe beside it (fig. 63).

19. *Amphiascus robinsoni* (A. Scott, 1902). (Fig. 64.)

Gurney, 1927, p. 524.

Associated with the preceding species.

Female up to 0·65 mm., male 0·55 mm.

The outer branch of the first foot is equal to the first joint of the inner branch; the second and third joints of the inner branch are equal and taken together less than half the length of the first joint; as in *A. erythræus*, the middle joint of the outer branch is without an inner seta. The leg-formula shows its affinity to the *hispidus*-group as noted by Gurney, but there is a slight discrepancy in his table, in which two inner setæ are ascribed to the third joint of the fourth endopod:—

	Endopod.			Exopod.		
p2	1	1	121	0	1	023
p3	1	1	221	0	1	123
p4	1	1	121	0	1	223

The appearance of the transformed endopod of the second foot in the male differs according to the angle from which it is viewed. Fig. 64 represents it when seen from in front; the ciliation of the outer border, the enlarged spur on the first joint inside, the tongue-like process near the base of the second joint, the brown-coloured bayonet-shaped process at the apex, and the pale finger-like bristle opposed to it are all distinctive.

In the first foot of the male the two pigmented knobs at the base of the first joint inside and the dusky hyaline, almost rectangular lamella projecting from the basipod in front of the knobs, conform to Gurney's description.

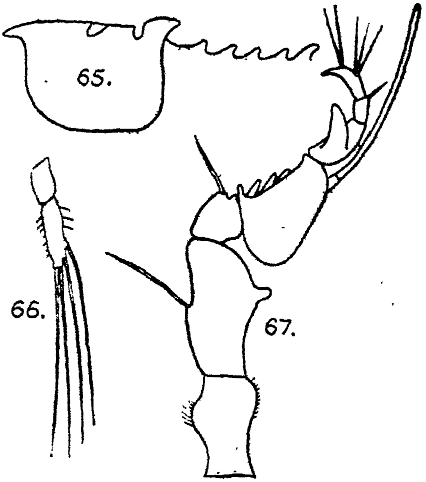
20. *Laophonte armiger*, Gurney. (Figs. 65–67.)

Abundant in Mangrove Lake. Females up to 0·65 mm., males 0·54 mm.

In side-view the body presents a serrated dorsal contour, and the head is marked by a low median crest with a pit in the middle and terminating behind in a wedge-shaped tooth preceded by an open notch; the remaining segments are elevated (fig. 65). The dorsal armature of the penultimate segment is like that of *L. brevispinosa*, Sars. The normal leg-formula is:—

	Endopod.		Exopod.		
p2	0	120	0	1	122
p3	0	220	0	1	223
p4	0	120	0	1	222

The distinguishing feature is the presence of only two spines outside the third joint of the second exopod (p2Re3). The formula is the same for the male, since the endopod of the third foot of the male is not transformed; the only trace of any modifying influence is the presence of three spaced chitinous cilia on the inner edge of the second segment instead of a row of cilia (fig. 66). The exopods of the third and fourth pairs of legs in the male are slightly thickened, and the outer spines somewhat stronger; the terminal joint of the exopod in each of these legs is longer than the first joint in the female, shorter than the first joint in the male. The fifth foot of the male is of the *horrida*-type, without inner lamella, the distal lamella



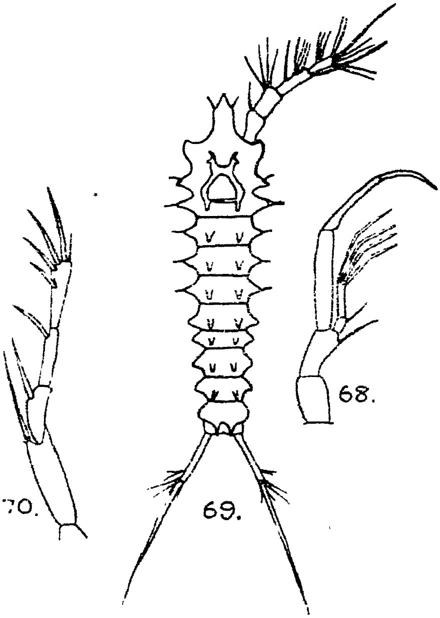
Laophonte armiger, Gurney.

Fig. 65.—Part of dorsal contour.
Fig. 66.—Third endopod of male, not transformed.
Fig. 67.—Right anterior antenna of male.

bearing three graded ciliate setæ of which the innermost is longest. In the first antenna of the male (fig. 67) the terminal joint is claw-shaped, and, in addition, the fifth joint is produced into a great accessory claw, as in *L. koreni* Boeck.

21. *Laophonte cornuta*, Philippi.

Abundant among material from spines of *Arbacia.* Females 1 mm., males 0·7 mm. This is a widely distributed species, the type of the genus, but it has not been found on the Atlantic coast of America.

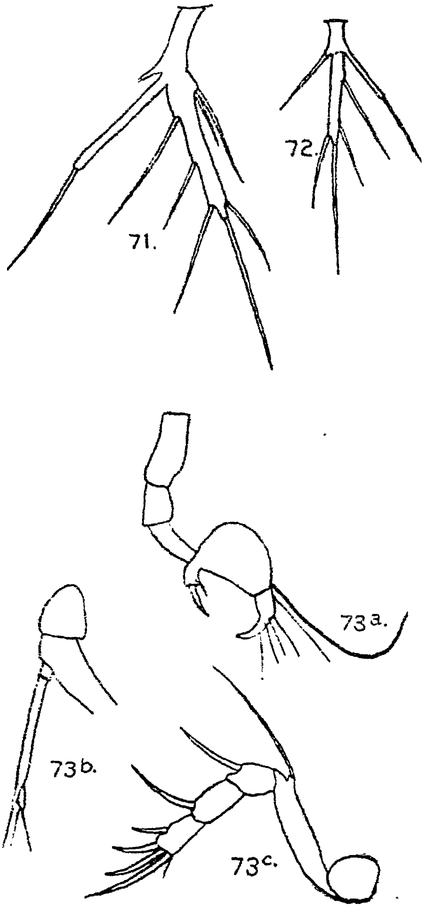


Laophonte echinata, sp. n.

Fig. 68.—First foot.
Fig. 69.—Outline of body from above.
Fig. 70.—Fourth foot, no endopod.

22. *Laophonte echinata*, sp. n. (Figs. 68–73.)

Found in association with the preceding, and again in Mangrove Lake. Females about 0·5 mm., males 0·44 mm. Its chitinous armature bears some resemblance to that of *Echinopsyllus normani*, Sars, but it is a true *Laophonte*, as shown by the structure of the first pair of feet, of which the outer branch is two-jointed and bears at the end four geniculate setæ (fig. 68). The segments form lateral protuberances, some of which are tipped with a small seta,



Laophonte echinata, sp. n.

Fig. 71.—Female fifth foot.
Fig. 72.—Male fifth foot.
Fig. 73 *a*.—Male antennule.
Fig. 73 *b*.—Proximal portion of third foot of the male, showing the modified styliform endopod.
Fig. 73 *c*.—Left second foot of male from behind.

and each bears a pair of recurved spiniform processes above (except the anal segment); the horn-like processes at the back of the head are connected with an elaborate chitinous framework of the head (fig. 69). The anterior antennæ are four-jointed, as they are in *L. cornuta* and also in *Echinopsyllus*. The posterior antenna is two-jointed, the two divisions equal in length, but the distal one more slender; there is no outer branch. The mandible-palp is simple, with convex outer border bearing three lateral setæ and a plumose apical seta. There are no endopods on the natatory feet of the female, and no inner setæ except a delicate inconspicuous seta near the proximal end of the basipod of the third leg. With this exception the number of setæ is the same on the second, third, and fourth legs (fig. 70). In the fifth legs the parts are not very obviously separated; the peduncle of the lateral seta is very long, and in the female there is an accessory process at the base outside (figs. 71 & 72).

On the third foot of the male there is a slender three-jointed modified endopod, consisting of very short proximal and distal joints and a long middle joint, as in *Laophontodes*, arising from the proximal part of the basipod at the point where there is only a delicate seta in the female (fig. 73 *b*).

The caudal stylets are long and slender, the length seven or eight times the breadth. They may appear more attenuated than in the figure, equal to the last two segments combined.

23. *Normanella minuta* (Boeck). (Figs. 74, 75.)

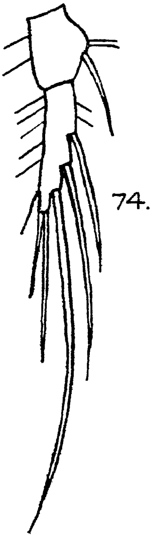
Mangrove Lake. Female 0·425 mm., male 0·355 mm.

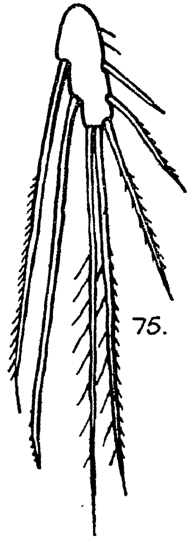
The dorsal edges of the segments present a moniliform denticulation; in side-view the rows of long ventro-lateral spinules pass abruptly into the dorsal conules, as shown in a figure by Sars; in ventral view there is a wide gap free from spinules on each of the second, third, and fourth segments of the urosome in the male. Although the natatory legs are not transformed in the male, some of the setæ may be shortened (fig. 74). In the fourth foot the two inner setæ of the third joint of the exopod are equally strong and nearly equal in length, the first one pectinate inside, the second nearly smooth (fig. 75). In the second joint of the third endopod of the male the outer terminal seta is reduced.

24. *Ceyloniella armata* (Claus). (Figs. 76–78.)

Gurney, 1927, p. 567.

Amongst *Arbacia* material, rock-scrapings at low tide,

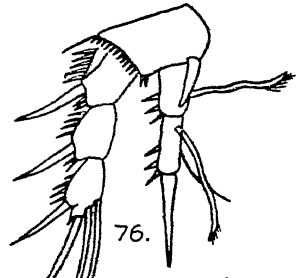


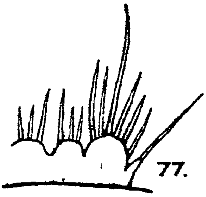


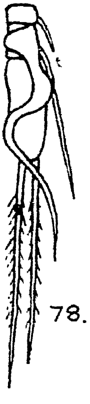
Normanella minuta (Boeck).

Fig. 74.—Second endopod of male.

Fig. 75.—Third joint of fourth exopod of male.







Ceylonia armata (Claus).

Fig. 76.—Female first foot.

Fig. 77.—Male fifth foot.

Fig. 78.—Third endopod of male.

submerged bottles, etc. Female and male 0·8 mm. This is a bluish green, subcylindrical, gently tapering form. The structure of the first foot is especially striking, each division of the two-jointed endopod bearing a long serpentine bristle (fig. 76). In the fifth foot of the female the two lamellæ are distinct, five setæ on the distal, six on the inner. In the male, as observed by Thompson and Scott, the lamellæ are confluent, three setæ on the inner, six on the distal (fig. 77). In the third foot of the male the endopod is three-jointed and the middle joint gives rise to a serpentine *mucro* adnate to the third joint (fig. 78). The generic name has been altered by C. B. Wilson to *Ceyloniella* (Proc. U.S. Nat. Mus. lxiv. art. 17, 1925). *Ceylonia* was applied by G. B. Buckton in 1891 to the Ceylon-Tea Aphid (Ind. Mus. Notes, ii. 1891, p. 35).

SUMMARY.

Correlation has been demonstrated between the Harpacticoid faunule of Bermuda and that of the Suez Canal zone. A new genus has been established, several new species and a number of males have been described. Especially noteworthy is the lack of transformation of the inner branch of the third foot in the male *Laophonte armiger*. In the parallel instance of *L. perplexa* Sars says :—" A remarkable feature is that the inner ramus of the third pair of legs in the male does not exhibit any trace of the conspicuous transformation found in all other species of the genus *Laophonte*."

It may be added that the material so far examined is only a small fraction of the amount collected.

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EXPLANATION OF PLATE V.

Fig. 25. *Nitocra lacustris* (Schmankevitsch). First pair of feet of female.
Fig. 38. *Diagoniceps lævis*, sp. n. Third pair of feet of female.

XII.—*New or little-known* Tipulidæ (*Diptera*).—XLVI. *Australasian Species.* By CHARLES P. ALEXANDER, Ph.D., F.E.S., Massachusetts Agricultural College, Amherst, Massachusetts, U.S.A.

IN the present instalment, I wish to discuss species of the genus *Gynoplistia* from New South Wales and Victoria. This abundant material was taken in New South Wales by Mr. A. J. Nicholson, and in Victoria by Messrs. Borch, Clark, Hill, and Wilson. The Nicholson material is preserved in the Macleay Collections of the University of Sydney, the Clark and Hill material in the National Museum, Victoria, while the rich Wilson collections have been returned to the collector. I wish to express my sincere gratitude to all of the above-named gentlemen for their continued co-operation in making known the involved Australian crane-fly fauna.

Gynoplistia (*Paralimnophila*) *præsignis*, sp. n.

General coloration grey, the præscutum with three distinct black stripes; a continuous median dark vitta extending from the suture to the abdomen; femora black, the bases obscure yellow; tarsi yellowish brown, not conspicuously brightened; wings whitish, conspicuously variegated with dark brown spots and paler brown washes, the prearcular region bright yellow.

Female.—Length about 22 mm.; wing 17 mm.

Rostrum dark reddish brown; palpi brownish black. Antennæ (♀) 17-segmented, the formula being 2+7+8; first segment brown, darker above; flagellum black; longest branch (about flagellar segment 3 or 4) a little more than one-half the segment. Head grey, the vertex and occiput with a longitudinal brown area.

Pronotum pale reddish, darker medially, the surface sparsely pruinose. Mesonotal præscutum with three conspicuous brownish-black stripes that are well separated; humeral region brighter, pruinose laterally; pseudosutural foveæ large, pale reddish in colour and relatively inconspicuous; posterior interspaces more yellowish; scutum with the lobes largely covered by two confluent black areas; median area of scutum dusky yellow, with a median dark vitta; scutellum obscure fulvous, more pruinose behind, with a median black area; postnotal mediotergite light grey pruinose, with a median dusky line that narrows to a point behind; antero-lateral regions of the mediotergite and dorsal portions of the pleurotergite more yellowish. Pleura ventrally light grey pruinose, the propleura and anepisternum with a broad darker brown longitudinal stripe; dorsal portions of pteropleurite and pleurotergite paler; dorso-pleural region buffy yellow. Halteres obscure yellow, the knobs blackened. Legs with the coxæ heavily pruinose; trochanters reddish brown, pruinose; femora black, the bases restrictedly obscure yellow; genua very narrowly and obsoletely brightened; tibiæ brown, the bases narrowly blackened, the tips slightly more broadly so; tarsi yellowish brown, the outer segments passing into black. Wings with the ground-colour whitish, the base yellow; cell *C* extensively infumed, cell *Sc* more yellowish; a heavy dark brown pattern, with paler brown longitudinal washes in the medial field; the darker areas are distributed as follows:—In cell *R* at near one-fourth the length; a larger area at origin of *Rs*; stigma, with barely contiguous areas at fork of R_{2+3+4} and fork of *Rs*; a circular area at distal end of R_3; other paler clouds on the posterior cord, *m*, and fork of M_{1+2}; the dusky washes, in addition to cell *M* as described, include also the outer ends of the anal cells, mid-length of cell *Cu* and clouds near outer end of cell 1*st A*, at mid-length of cell 2*nd A* and in the axilla; veins of prearcular and radial fields yellow, dark brown in the infuscated areas; veins of the posterior fields of wing dark brown. Venation: R_{2+3+4} about one-half R_{2+3}, the latter shorter than R_{1+2}; basal section of R_5 arcuated; *m–cu* shortly beyond the fork of *M*.

Abdomen dark brown, the intermediate tergites more brightened medially, the surface more or less pruinose; genital segment paler, more reddish grey; sternites pale grey. Ovipositor with the valves reddish horn-colour, the dorsal valves blackened at base, rather strongly upcurved to the subacute tips.

Hab. Victoria.

Holotype, ♀, Bogong High Plains, altitude 5600–6000 feet, January 1928 (*F. E. Wilson*).

Gynoplistia (*Paralimnophila*) *stolida*, sp. n.

General coloration grey; mesonotal præscutum yellowish grey with four very conspicuous black stripes; no distinct dark pleural stripe; legs black, without pale colouring at the genua; all tarsi extensively whitened; wings creamy, with a very extensive brown pattern, appearing as areas along the cord and broad seams to many of the longitudinal veins; *m–cu* at mid-length of cell 1*st* M_2.

Female.—Length about 15 mm.; wing 11 mm.

Rostrum grey; palpi black. Antennæ black throughout, the basal segment pruinose; basal six flagellar segments a little produced near apex, the longest serrulation (about flagellar segment 4) not exceeding one-third the segment; terminal segments broken, but from size of the last segments, the antennæ presumably with not more than sixteen segments. Head grey, the centre of the vertex extensively infuscated.

Pronotum darkened, pruinose laterally. Mesonotal præscutum yellowish grey, with four very conspicuous black stripes, the intermediate pair scarcely separated by a capillary vitta on anterior portion; pseudosutural foveæ very large, black; posterior sclerites of mesonotum grey, the scutal lobes each with a large blackish area. Pleura dull grey dorsally, brighter bluish grey on the sternopleurite and the posterior sclerites; no distinct darkened pleural stripe; dorso-pleural region more yellowish grey. Halteres pale, the knobs infuscated. Legs with the coxæ pale brownish yellow, slightly infuscated at base; trochanters obscure yellow; femora obscure yellow basally, the tips broadly blackened; tibiæ black; tarsi with the basitarsi blackened, the tips and segments 2 and 3 whitish, the terminal tarsal segments again darkened. Wings with the ground-colour creamy, extensively variegated with darker; cells *C* and *Sc* uniformly infuscated; stigma oval, darker brown; the remaining dark pattern includes areas at origin of *Rs*; at near mid-distance between arculus and the first-named area; a circular dark area at outer end of R_3; conspicuous seams along the cord and outer end of cell 1*st* M_2; most of the veins beyond the cord, as well as the narrow wing-apex; a seam on the distal two-fifths of M; and all but the base of Cu; anal cells extensively darkened; veins dark brown. Venation: R_{2+3+4} shorter than basal section of R_5; R_{1+2} more than twice R_{2+3}; cell M_1 nearly twice its petiole; *m–cu* at mid-length of the relatively small cell 1*st* M_2.

Abdomen dark greyish brown; caudal margins of the intermediate sternites very narrowly and vaguely paler. Ovipositor with the long, nearly straight valves brownish horn-colour.

Hab. Victoria.

Holotype, ♀, Mountains near Warburton, altitude 3500–4000 feet, April 9, 1928 (*C. H. Borch*). Type returned to F. Erasmus Wilson.

Gynoplistia (*Paralimnophila*) *styligera*, sp. n.

General coloration grey; antennæ (♂) 21-segmented, with eighteen long-branched segments; antennæ (♀) 19-segmented; mesonotal præscutum light brown with four darker brownish-grey stripes that are narrowly but conspicuously margined with blackish; legs black, the genua restrictedly pale; all tarsi in part yellowish white; wings dusky, with a sparse darker pattern; *m–cu* just beyond the fork of M; male hypopygium with four long yellowish rods jutting from the genital chamber.

Male.—Length about 13 mm.; wing 12 mm.

Female.—Length about 17·5–19 mm.; wing 15–17 mm.

Male. Rostrum dark, pruinose; palpi black. Antennæ 21-segmented, the formula being 2+18+1; antennæ black, the basal segments a trifle paler; flagellar branches elongate, the longest (about flagellar segment 8) more than one-fourth the entire antenna; terminal simple segment longer than the last branch. Head grey, the centre of the vertex extensively infuscated.

Mesonotal præscutum light grey, with four darker brownish-grey stripes that are narrowly but conspicuously margined with blackish; pseudosutural foveæ relatively small, irregular in outline, black; scutal lobes and scutellum dark brown; postnotal mediotergite light grey, with a dark brown median line. Pleura light grey, with a broad velvety-black longitudinal stripe extending from the propleura to the pteropleurite; dorso-pleural region dull buffy. Halteres obscure yellow, the knobs blackened. Legs with the coxæ chiefly pale, the outer faces sparsely pruinose; trochanters brownish yellow; femora black, the bases narrowly obscure yellow, the extreme genua pale; setæ at bases of femora reduced to short spinulæ; tibiæ black; legs broken beyond the basal third of tarsi. Wings relatively narrow, with a dusky tinge; cells *C* and *Sc* darker; a relatively conspicuous brown and inconspicuous grey pattern; the brown areas include the origin of *Rs*, an area in cell *R* basad of the latter, the stigma and conspicuous spots on anterior cord and outer end of vein R_3; the paler areas include the posterior cord, outer end of cell 1*st* M_2, and fork of M_{1+2}; veins dark brown. Venation: R_{2+3+4} in alignment with *Rs*; R_3 beyond R_2 nearly straight, diverging very gradually from R_4; basal section of R_5 angularly bent at near mid-length; cell M_1 longer than its petiole; *m–cu* just beyond the fork of *M*.

Abdominal tergites dark brown; basal sternites mixed with obscure yellow; hypopygium dark. Male hypopygium with the outer dististyle as in the subgenus, the outer apical angle a stout, gently curved spine, the inner apical angle obtusely rounded. Four long, pale yellow rods extend from the genital chamber; two of these are more ribbon-like, gradually narrowed to the long acute tips, the surface longitudinally ribbed; the second pair are a little shorter, obtuse at tips. A blackened phallosomic structure extends laterad and caudad into two blackened arms.

Female. Generally as in the male, differing especially in the sexual characters. Size larger. Antennæ 19-segmented, the formula being 2+7+10; apex of second scapal and base of first flagellar segments restrictedly brightened. Tarsi of all legs extensively yellowish white, this including segments 2 and 3 and the tips of the basitarsi. Wings slightly broader.

Hab. Victoria.

Holotype, ♂, a damaged ♂, Bogong High Plains, altitude 5600–6000 feet, January 1928 (*F. E. Wilson*).

Allotopotype, ♀.

Paratopotype, ♀.

Gynoplistia styligera is most closely allied to *G. serraticornis*, Alexander, the female of which has eighteen antennal segments, with the serrations longer and involving ten of the segments.

Gynoplistia (*Paralimnophila*) *miseranda*, sp. n.

General coloration grey; præscutum with four brown stripes; antennæ (♂) 16-segmented, with thirteen branched segments; flagellum with coarse erect setulæ; legs black, the genua not brightened; all tarsi more or less yellowish; wings with a dusky suffusion, the dark pattern very diffuse and ill-defined; male hypopygium with the gonapophyses bifid at tips, the outer apical angle produced into a long sinuous rod.

Male.—Length about 7–8 mm.; wing 7–7·6 mm.; antenna about 4–4·2 mm.

Female.—Length about 11·5 mm.; wing 9 mm.

Rostrum grey; palpi brownish black. Antennæ (♂) 16-segmented, the formula being 2+13+1, black throughout; longest branch (about flagellar segment 7) approximately three times the segment itself; last branch very small, less than one-fourth the segment; segments and branches clothed with relatively coarse erect setulæ. Antennæ (♀) merely serrulate. Head brown, the front and orbits clear grey.

Pronotum grey. Mesonotal præscutum grey with four brown stripes, the intermediate pair confluent behind; pseudosutural foveæ large, black; posterior sclerites of mesonotum grey, the scutal lobes infuscated. Pleura clear light grey. Halteres dark brown, the base of the stem pale. Legs with the coxæ pale, sparsely pruinose; trochanters yellow, the outer faces infuscated; femora black, the bases narrowly obscure brownish yellow; tibiæ black; basitarsi black, the tips and segments 2 and 3 pale, with white setæ; apices of segments 2 and 3 and all outer tarsal segments dark, with pale setæ; posterior tarsi more evidently brightened than the others. In the fore tarsi of female the coloration is yellowish brown, but the setæ are white and very conspicuous. Wings with a dusky suffusion; cells *C* and *Sc* a little darker; stigma small, oval, darker brown; very vague and diffuse dark seams at origin of *Rs*, along cord, outer end of cell 1*st* M_2, fork of M_{1+2}, and end of R_3; veins dark brown. Venation: R_{1+2} a little shorter than R_{2+3+4} and subequal to R_{2+3}; cell R_3 widened at margin; cell M_1 subequal to or shorter than its petiole; *m–cu* at from one-third to one-fourth the length of cell 1*st* M_2.

Abdomen dark brown, vaguely pruinose; hypopygium dark; sternites obscure brownish yellow, darker laterally. Male hypopygium with the outer dististyle strongly expanded at apex, the inner angle strongly produced, obtuse, the outer angle a slender spine. Gonapophyses appearing as pale yellow blades, the mesal apical angle produced into a straight spine, the outer apical angle produced into a long slender sinuous rod.

Hab. Victoria.

Holotype, ♂, Bogong High Plains, altitude 5600–6000 feet, January 1928 (*F. E. Wilson*).

Allotopotype, ♀.

Paratopotypes, 4 ♂ ♀.

Gynoplistia miseranda suggests *G. setulicornis*, Alexander, in the coarse setulæ of the male flagellum, but differs conspicuously in the structure of the hypopygium.

Gynoplistia (*Paralimnophila*) *pallidicornis*, sp. n.

Mesonotal præscutum yellowish brown with nine narrow brown lines; antennæ (♀) 17-segmented, pale; a conspicuous dark brown pleural stripe; femora brownish yellow, deepening to pale brown just before the narrow pale tips; tibiæ pale yellowish brown; tarsi chiefly pale; wings creamy, variegated with dark brown spots and grey washes; *Rs* elongate, arcuated at origin.

Female.—Length about 19 mm.; wing 14 mm.

Rostrum dark brown, sparsely pollinose; palpi dark brown. Antennæ (♀) 17-segmented, the formula being 2+6+9; antennæ pale brownish yellow, the terminal segments passing into darker; basal flagellar segments very weakly serrate, the branch, apical in position, very small. Head dark brown, with a conspicuous yellow pollen, the anterior vertex more pruinose; a median brown vitta on the vertex, this more or less trifid at anterior end.

Mesonotal præscutum with the ground-colour yellowish brown, the three stripes concolorous, but conspicuously margined with dark brown; an additional narrow dusky line on the posterior interspaces; median pale stripe split by a capillary still darker vitta, making a total of nine dark lines shortly before the suture; scutum yellowish brown, the median area and centres of the lobes crossed by conspicuous dark lines; scutellum and postnotum yellowish grey, with a capillary median brown vitta, the posterior margin of the postnotal mediotergite dusky. Pleura pale buffy yellow dorsally, beneath which a very broad, conspicuous, dark brown longitudinal stripe passes from the cervical region, above the fore coxæ, crossing the ventral propleura and anepisternum, narrowed behind, ending at the posterior margin of the postnotal mediotergite, as described; ventral pleurites more pruinose. Halteres obscure yellow, the knobs brownish black. Legs with the coxæ and trochanters pale yellow; femora brownish yellow, clearer basally, before the tips deepening to pale brown, the narrow tips abruptly pale yellow; tibiæ pale yellowish brown, the extreme bases narrowly whitish, the tips narrowly darkened; tarsi yellowish white, the proximal half of the basitarsi a little darker, the tips of the individual tarsal segments narrowly darkened. Wings with a creamy-yellow ground-colour, the disk extensively variegated with a greyish wash, the ground-colour most clearly distinguishable in the prearcular region, before and beyond the origin of *Rs*, and in the outer ends of the marginal medial cells; cell *C* and cephalic margin of *Sc* brown; stigma broken, variegated brownish yellow and dark brown; extensive brown clouds in cell *R*, the most conspicuous being a rectangular one at origin of *Rs*; small and narrow darker brown areas at origin and fork of *Rs*, fork of R_{2+3+4}, *r–m*, as narrow seams on *m–cu*, and outer end of cell 1*st* M_2; more conspicuous spots at tip of R_3 and fork of M_{1+2}; outer radial cells rather conspicuously infuscated; veins chiefly dark brown. Venation: *Rs* very long, arcuated at origin; R_{2+3+4} shorter than the basal section of R_5; R_{1+2} subequal to R_{2+3}; cell M_1 about twice its petiole; cell 1*st* M_3 irregularly long-hexagonal, *m* less than half the basal section of M_3; *m–cu* more than one-half its length beyond the fork of *M*.

Abdominal tergites chiefly brown, somewhat darker sublaterally, the outer segments more pruinose; sternites rather heavily pruinose; ovipositor with the basal half of the tergal valves and all of the sternal valves darkened, the remainder yellowish horn-colour. Tergal valves of ovipositor slender, gently upcurved to the acute tips.

Hab. Victoria.

Holotype, ♀, Cann River, Eastern Gippsland, November 1928 (*J. Clark*).

Gynoplistia pallidicornis is distinct from all of the numerous species of the subgenus so far defined.

Gynoplistia (*Gynoplistia*) *clarki*, sp. n.

General coloration dull grey; antennæ (♂) 19-segmented, with thirteen or fourteen branched segments; mesothorax entirely opaque; halteres with black knobs; legs orange, the tips of the femora and tibiæ narrowly blackened; wings pale brownish yellow, with a heavy dark brown pattern; abdomen, including the hypopygium, orange.

Male.—Length about 10·5–11 mm.; wing 9·2–10 mm.

Rostrum black, pruinose, with long erect yellow setæ; palpi black. Antennæ (♂) 19-segmented, the formula being 2+2+12+3 or 2+2+11+4; black, the first flagellar segment and incisures of the succeeding four or five segments more brownish; longest branch (about flagellar segment 5) more than two-fifths the entire flagellum; last branch fully twice the segment. Head dull black, with a small vertical tubercle; genæ with conspicuous brushes of yellow setæ.

Pronotum with a light grey and brown pruinosity. Mesonotal præscutum entirely covered with an appressed pubescence, with three dark grey stripes that are narrowly bordered by paler grey, the interspaces with a more yellowish pubescence, becoming more elongate laterad of the outer stripes; pseudosutural foveæ large, black, with a brown spot immediately behind each, opposite the anterior ends of the lateral stripes; scutal lobes dull black, bordered by grey pubescence; scutellum more piceous; postnotum dark grey. Pleura dark, with a heavy grey pubescence and with conspicuous yellow setæ on the sternopleurite, pteropleurite, and on a conspicuous rounded lobe immediately before the wing-root. Halteres with the extreme base blackened, the remainder of the stem obscure fulvous, the knobs blackened. Legs with the coxæ and trochanters black, the former with a greyish-white pruinosity; femora orange, the tips very narrowly blackened; tibiæ somewhat more obscure orange, the tips narrowly blackened; basal segments of tarsi obscure orange-brown, the tips and remainder of tarsi blackened. Wings with the extreme base blackened, the remainder of the prearcular region orange; membrane pale brownish yellow, with a heavy dark brown pattern, arranged as follows: At *h*; large areas in bases of cells *R* and *M*; origin of *Rs* and on anterior cord, the latter connected with the stigmal area; posterior cord and outer end of cell *1st* M_2 narrowly seamed with dusky; a brown spot in cell *1st A* adjoining the vein at near two-thirds its length and another adjoining vein *2nd A* near mid-length; a dusky seam along *Cu*. Venation: *Rs* long, angulated at origin; cell M_1 present; *m–cu* beyond mid-length of cell *1st* M_2.

Abdomen with the first segment black, the remainder of the organ, including the hypopygium, orange. Male hypopygium with the single dististyle yellow, the tip narrowly blackened, provided with two or three blackened spines. Gonapophyses appearing as broad plates. Ædeagus very stout.

Hab. Victoria.

Holotype, ♂, Goulburn River, Alexandra, November 7, 1927 (*J. Clark*).

Paratopotype, ♂ (*G. F. Hill*).

I take great pleasure in naming this distinct *Gynoplistia* in honour of the collector of the type, Mr. John Clark.

Gynoplistia (*Gynoplistia*) *fulvoabdominalis*, sp. n.

Belongs to the *melanopyga* group; allied to *nigrotibialis*; antennæ (♂) with thirteen branched segments; mesonotum extensively polished black; halteres with dark brown knobs; femora fulvous, the tips broadly blackened; wings faintly brownish, the prearcular region yellow, the veins seamed with darker; abdomen fulvous-yellow, including the hypopygium; male hypopygium with the interbasal plate bearing a single blackened spine.

Male.—Length 9–10 mm.; wing 8–9 mm.

Rostrum black, dusted with grey, provided with conspicuous erect yellow setæ; palpi black. Antennæ black throughout, 18-segmented, the formula being 2+2+11+3; longest branch (about flagellar segment 5 or 6) approximately two-fifths the organ; last branch shorter than the segment; terminal segment elongate, much exceeding the penultimate and probably produced by fusion of two segments; in cases, the antennæ are 19-segmented, the formula being 2+2+11+4, the terminal segments being distinctly separated. Front dusted with grey; remainder of head black, sparsely pruinose.

Pronotum black, sparsely pruinose. Mesonotal præscutum polished black, the lateral margins slightly pruinose, the surface of the usual stripes microscopically transversely striolate; posterior interspaces with yellow setæ; scutum and scutellum polished black; postnotum dull black, including the pleurotergite. Pleura heavily grey pruinose, on the dorso-pleural region more yellowish grey, especially on the anepisternum; sternopleurite black, highly polished, especially ventrally. Halteres obscure yellow, the knobs dark brown. Legs with the coxæ black, heavily pruinose; trochanters black; femora fulvous basally, the tips extensively blackened, this including a little less than the distal third to fourth on the fore legs and about the distal fourth to fifth on the hind legs; tibiæ black to brownish black, in the latter case, the tips blackened; tarsi black. Wings with a faint brown tinge, the base more creamy, the prearcular region yellow; cells *C* and *Sc* more infuscated; stigma dark brown; large, conspicuous brown areas at origin of *Rs* and on the anterior cord; narrower brown seams on posterior cord, outer end of cell 1*st* M_2, and on most longitudinal veins, more conspicuous along vein Cu_1 in cell *M*;

a brown cloud in cell *1st A* at near two-thirds the length of the vein; no darkening at proximal ends of cells *R* or *M*; veins black, the prearcular veins more yellow. Venation: *Rs* angulated at origin; veins R_3 and R_4 widely divergent; *m–cu* close to mid-length of cell *1st* M_2; vein *2nd A* strongly sinuous.

Abdomen with the first segment black, the remainder of the abdomen, including the hypopygium, deep fulvous-yellow, the subterminal tergites in cases margined caudally with darker. Male hypopygium with the dististyle single, yellow, the narrowly obtuse tip blackened. Interbasal plates with a single conspicuous blackened spine. Ædeagus profoundly bifid, as in the group.

The Ringwood paratype is larger (♂, length about 12 mm.; wing 10 mm.), but agrees closely with the type except in the coloration of the abdomen, the caudal and lateral margins of the tergites extensively blackened, more extensively so on the outer segments where they are uniformly darkened, the hypopygium reddish yellow.

Hab. Victoria.

Holotype, ♂, Grampians, October 1928 (*F. E. Wilson*).

Paratopotypes, 2 ♂ ♂; *paratypes*, 1 ♂, Ringwood, October 11, 1928 (*C. Borch*); 1 ♂, Millgrove, altitude 440 feet, February 10, 1929 (*F. E. Wilson*).

Gynoplistia fulvoabdominalis is readily distinguished from the other members of the *melanopyga* group by the coloration and the structure of the male hypopygium. *G. simplex*, Alexander, is distinguished by the uniform black coloration and the presence of a long slender spine on the interbasal plate, in addition to the usual stouter black spine. *G. nigrotibialis*, Alexander, is distinguished by the structure of the antennæ, the coloration, and the structure of the interbasal plate, which bears a long slender spine that terminates in a spatulate head. The other known members of the group are readily told by the shape of the dististyle.

Gynoplistia (*Gynoplistia*) *chalybicolor*, sp. n.

General coloration metallic blue; antennæ (♂) with ten branched segments, of female with six or seven branched segments; legs black throughout; wings whitish subhyaline, with a sparse dark pattern; male hypopygium with the inner dististyle a powerful blackened curved rod, the tip acute; ædeagus long and slender.

Male.—Length about 6·3–6·5 mm.; wing 6·5–7 mm.

Female.—Length about 7·5 mm.; wing 7 mm.

Rostrum and palpi black. Antennæ (♂) 16-segmented, the formula being 2+2+8+4; black throughout; branch of first flagellar segment approximately three times the segment; longest branch (about flagellar segment 5) approximately six times the segment and nearly one-third the length of the flagellum; branch of tenth flagellar segment approximately equal to the segment. Antennæ (♀) 14- to 15-segmented, the formula being 2+2+4+6 or 2+2+4+7; branches relatively elongate, the longest (about flagellar segment 3) approximately twice the segment. In the Kosciusko material, the seventh flagellar segment has an additional small branch. Head shiny metallic blue.

Mesonotum shiny metallic blue, the præscutum smooth. Pleura with a light grey pruinosity. Halteres short, pale yellow, in cases with the knobs infuscated. Legs with the coxæ light grey; remainder of legs coal-black. Wings whitish subhyaline, with a sparse dark pattern; cells *C* and *Sc* dark brown; a circular area at origin of *Rs* and a conspicuous area including the stigma and a blotch on the anterior cord dark brown; wing-apex, posterior cord, and vein *Cu* less distinctly infumed; a faint dark cloud near outer end of cell 1*st A*; veins brownish black. Venation: R_{2+3+4} very short; basal section of R_5 correspondingly elongate, arcuated; cell M_1 nearly twice its petiole; cell 1*st* M_2 small, subrectangular, *m–cu* at near one-third its length.

Abdomen metallic blue, including the hypopygium. Male hypopygium with the ninth tergite large, narrowed outwardly, the caudal margin gently emarginate. Basistyle deeply notched at apex, forming an inner and an outer stout setiferous lobe, the dististyles being borne in the notch; mesal margin of basistyle bearing a conspicuous inter-basal lobe that is tufted with long yellow setæ. Outer dististyle reduced to a microscopic oval structure. Inner dististyle a powerful blackened curved rod that narrows to the acute blackened tip, the concave side with abundant microscopic setæ and punctures. Gonapophyses appearing as spatulæ, the stem long and slender, the blade long-oval. Ædeagus long, slender, straight, subtended by a narrow lateral flange except at apex.

Hab. Victoria, New South Wales.

Holotype, ♂, Bogong High Plains, Victoria, altitude 5600–6000 feet, January 1928 (*F. E. Wilson*).

Allotopotype, ♀.

Paratopotype, ♀; *paratypes*, 1 ♂, 2 ♀ ♀, Mt. Kosciusko, New South Wales, November 27, 1921 (*Nicholson*).

Gynoplistia (*Gynoplistia*) *wilsonella*, sp. n.

Belongs to the *vilis* group; allied to *vilis*, Walker; coloration dull; antennæ black, 17-segmented, in male with thirteen long-branched segments; knobs of halteres darkened; legs black; wings pale yellow, with a very restricted dark pattern, including cells *C* and *Sc*; prearcular region bright yellow; male hypopygium with the basistyle produced at apex into a long slender spine.

Male.—Length about 10–14 mm.; wing 11–14 mm.

Rostrum dark brown, sparsely pruinose; palpi dark brown. Antennæ (♂) 17-segmented, the formula being $2+3+10+2$; scapal segments dark brown, the flagellum and branches black; antennæ relatively elongate, if bent backward extending to some distance beyond the base of the abdomen, the segments correspondingly lengthened; branches long and conspicuous, the longest more than six times the segment; last branch nearly three times the segment. In rare cases, there is an additional flagellar segment which is weakly branched. Head light grey, darker medially, the front paler; brownish-ochreous areas on the anterior vertex at narrowest part.

Pronotum greyish brown. Mesonotal præscutum dull, being chiefly covered by four grey stripes, the narrower interspaces conspicuously dark brown; median brown stripe entire and very distinct, the lateral stripes shorter and sometimes obsolete; humeral region and lateral margin still darker; pseudosutural foveæ linear, dark reddish brown; scutum reddish brown, heavily pruinose; scutum brown, pruinose, with conspicuous yellow setæ; postnotum grey, with a median dark line. Pleura reddish brown, heavily pruinose, with a narrow longitudinal brown stripe on dorsal half, the sternopleurite usually darkened. Halteres obscure yellow, the knobs dark brown. Legs with the coxæ pale, grey pruinose; trochanters obscure yellow; remainder of legs black, only the femoral bases narrowly brownish yellow. Wings with a pale yellow ground-colour, the dark pattern sparse; cells *C* and *Sc* darkened; stigma large, oval, dark brown, its caudal margin limited by the strongly arcuated R_{2+3}; very restricted brown clouds and seams at origin of *Rs*; anterior cord and as very narrow seams to most of the longitudinal veins; posterior and apical portions of wing diffusely infumed; prearcular region narrowly but conspicuously light yellow; conspicuous longitudinal white streaks in cells *R*, 1st M_2, outer end of *M*, and base of M_3; veins dark brown. Venation: *Rs* long, arcuated at origin;

cell M_1 deep, approximately two and one-half to three times its petiole ; cell *1st* M_2 small and broad, *m–cu* at or beyond two-thirds the length ; vein *2nd A* sinuous.

Abdomen chestnut-yellow, the lateral margins darker, the subterminal segments more infuscated ; hypopygium brighter yellow. Male hypopygium with the basistyle produced apically into a long slender spine. Outer dististyle longest, dilated basally, much narrowed before the apex which is expanded into a flattened head, the outer angle produced into a spinous point. Inner dististyle shorter, the base conspicuously expanded, the remainder strongly curved to the obtusely rounded apex. Ædeagus very depressed, subtended on either side by the straight flattened gonapophyses, these directed caudad.

Hab. Victoria.

Holotype, ♂, Grampians, October 1928 (*F. E. Wilson*).

Paratopotypes, 12 ♂ ♂.

I take great pleasure in naming this distinct *Gynoplistia* in honour of my friend Mr. F. Erasmus Wilson. The species is amply distinct from the other known members of the *vilis* group. It is rather surprising that the extensive series consisted only of males, indicating the possibility that the female is subapterous and thus not readily detected.

Gynoplistia (*Gynoplistia*) *myallensis*, sp. n.

Belongs to the *vilis* group ; allied to *vilis*, Walker, differing especially in the structure of the antennæ and details of the male hypopygium.

Male.—Length about 10 mm. ; wing 12 mm.

Grey coloration of the head and the four præscutal stripes more suffused with brown. Antennæ (♂) 19-segmented, the formula being 2+3+13+1 ; branches long and slender, that of flagellar segment 15 a little less than twice the segment, of segment 16 very short, about one-half the segment ; terminal segment elongate, as in the group ; scape and flagellar segments 1 to 4 fulvous, the remaining segments and all branches black. Legs about as in *vilis*, the femora and tibiæ fulvous, with relatively narrow black tips ; posterior basitarsi brownish yellow, the tips a little darkened ; remainder of the posterior tarsi dark brown. Wings and abdomen about as in *vilis*. Male hypopygium with the terminal spine of the basistyle stout, the apex glabrous. Outer dististyle relatively slender, the apex obtuse, one angle terminating in a small blackened point. Inner dististyle broadly expanded at base, the distal half narrowed and strongly curved, the apex obtuse, at near mid-length of the narrowed portion on outer face with two long powerful bristles.

Hab. New South Wales.

Holotype, a broken ♂, Myall Lakes, September 3, 1922 (*Nicholson*).

The various members of the *vilis* group show the following range in antennal segments and arrangement of branches:—

G. wilsonella, sp. n., 17 segments, formula 2+3+10+2.
G. vilis, Walker, 18 segments, formula 2+3+12+1.
G. myallensis, sp. n., 19 segments, formula 2+3+13+1.
G. davidsoni, Alexander, 21–22 segments, formula 2+3+14+3 or 2+3+13+3.
G. doddi, Alexander, 24 segments, formula 2+3+17+2.

I have never seen a specimen that agrees with Macquart's definition of *G. flavitarsis*, Macquart; this calls for a fly having the basal *two* segments of the posterior tarsi pale yellow, the remaining segments black. From Macquart's figure, the antennæ appear to be intermediate between *wilsonella* and *vilis*, the formula as shown being 2+3+11+?, presumably indicating an organ with either seventeen or eighteen segments.

Gynoplistia (*Gynoplistia*) *argyropleura*, sp. n.

General coloration of head blue, of thorax blue-green, the mesonotum with only a delicate sculpturing; antennæ 19-segmented, with twelve branched segments in male; halteres chiefly obscure fulvous; femora yellow, the tips scarcely darkened; posterior tibiæ with a white subterminal ring; abdomen bicoloured, purplish blue, ringed with reddish yellow; hypopygium orange.

Male.—Length about 8 mm.; wing 7·8 mm.

Rostrum short, polished blue; palpi black. Antennæ black throughout, 19-segmented, the formula being 2+2+10+5; longest branch (about flagellar segment 5 or 6) a little more than one-third the length of the flagellum; last branch about one-half the segment; terminal segment about one-half longer than the penultimate. Head polished blue.

Pronotum and mesonotum polished blue-green, the præscutal stripes nearly smooth; scutellum fringed with yellow setæ. Pleura with a very heavy silvery appressed pruinosity; ventral sternopleurite and pleurotergite glabrous, the latter more conspicuously striolate; pseudosutural foveæ extensive, blackened. Halteres obscure fulvous, slightly suffused with brown. Legs with the fore and middle coxæ light brown, the posterior coxæ darker, all coxæ heavily grey pruinose; trochanters black; femora yellow, the tips scarcely darkened; tibiæ dark brown, darker at tips; posterior tibiæ with a narrow china-white ring more than its own length before the tip, both the membrane and setæ white; tarsi black. Wings yellowish, with a somewhat restricted brown pattern; a small area at origin of *Rs*; a large, obliquely triangular area, including the stigma and anterior cord; posterior cord and outer end of cell 1*st* M_2 more narrowly darkened; wing-tip broadly paler brown; a brown seam along vein *Cu* to margin; a vague grey cloud near outer end of cell 1*st A*; veins black, the prearcular veins more yellowish. Veins with abundant macrotrichia, including all branches of *Rs*. Venation: *Rs* long, weakly angulated at origin; cell M_1 longer than its petiole; *m–cu* more than one-half its length beyond the fork of *M*.

Abdomen with the basal two tergites purplish blue; segments 3 and 4 yellow, the tips purple, the amount nearly equal to the basal ring; succeeding tergites blackish purple, the bases very narrowly reddish yellow; sternites more extensively yellowish; hypopygium orange-yellow. Male hypopygium with the outer dististyle small, pale yellow, a little less than one-half the length of the inner, the latter very gently arcuated, yellow, tipped with black. Gonapophyses appearing as broadly flattened plates that terminate in an acute spine, with a longer spine on the inner margin near base. Ædeagus relatively long, the lateral flange ending some distance before tip.

Hab. Victoria.

Holotype, ♂, Ben Cairn, near Millgrove, in beech gully, altitude 2900–3200 feet, February 9, 1929 (*F. E. Wilson*).

Despite certain conspicuous differences, the present species seems to be most closely allied to *G. alpigena*, Alexander.

Gynoplistia (*Gynoplistia*) *aurantiocincta*, sp. n.

General coloration of thorax polished metallic greenish black; antennæ (♂) 21-segmented, with sixteen branched segments; halteres brownish black; femora orange, tipped with black; tibiæ black, the posterior tibiæ with a broad orange annulus; wings creamy, the prearcular region bright yellow, the wing-pattern relatively heavy; abdomen orange, the terminal segments purplish black; male hypopygium with the caudal margin of the ninth tergite terminating in two small tubercles.

Male. Length about 10 mm.; wing 9 mm.

Rostrum and palpi black. Antennæ 21-segmented, the formula being 2+2+14+3; longest branch (about flagellar segment 5 or 6) more than one-half the length of the flagellum; last branch a mere spur, approximately one-third the segment; basal flagellar segments short and crowded, these becoming longer outwardly; antennæ black, the axes of the first two flagellar segments paler. Head polished black, with violaceous reflexions.

Pronotum shiny black. Mesonotal præscutum polished metallic green or greenish black, the surface without distinct striations; remaining sclerites of mesonotum deep purplish black, with bronzy reflexions. Pleura black, very heavily silvery white pruinose, the anterior half of the sternopleurite and anepisternum glabrous, purplish black, highly polished. Halteres brownish black throughout. Legs with the coxæ black, heavily white pruinose; trochanters black; femora orange, the tips conspicuously blackened, the amount subequal on all legs; tibiæ black, the posterior tibiæ with a broad orange ring, this colour including the setæ, the bases of the segment narrowly, the tips broadly of the ground-colour; on the other legs, the orange ring is only slightly indicated, especially evident on the mid-tibiæ, the setæ here being dark-coloured; tarsi black. Wings creamy, the prearcular region conspicuously bright yellow; a relatively heavy brown pattern, appearing as a quadrate area at origin of *Rs*; a larger one from the stigma across the anterior cord; narrower seams on posterior cord and outer end of the cell 1*st* M_2; a conspicuous dark seam along vein *Cu*; wing-apex extensively paler brownish grey; a large grey area near outer end of cell 1*st* *A*; veins black, yellow in the prearcular area and basal third of *Sc*. Venation: veins R_3 and R_4 divergent, the latter gently sinuous; cell 1*st* M_2 relatively small, *m–cu* at about one-fifth its length.

Abdomen with the basal segment black; segments 2, 3, and the basal two-thirds of 4 bright orange; remaining segments, including the hypopygium, purplish black. Male hypopygium with the caudal margin of the ninth tergite gently convex, with a small blackened tubercle on either side of the median line, these separated by a small U-shaped notch. Basistyles relatively stout, terminating in two short lobes. Dististyle single, relatively long and slender, uniformly blackened, bent at mid-length and thence narrowed to a point. Phallosomic structures complex, the two most conspicuous elements being a pale yellow boomerang-shaped structure and a more dilated plate that terminates in a long sinuous spine.

Hab. Victoria.

Holotype, ♂, Monbulk, January 28, 1929 (*F. E. Wilson*).

Gynoplistia aurantiocincta is very different from the other Australian species that have a pale ring on the posterior tibiæ.

Gynoplistia (*Gynoplistia*) *eburneocincta*, sp. n.

Belongs to the *viridithorax* group; general coloration greenish black (♂) or castaneous (♀), the præscutal stripes metallic green, transversely striolate; antennæ (♂) 20-segmented, with thirteen branched segments; halteres dusky; legs black, the femoral bases pale; posterior tibiæ with a relatively narrow ivory-yellow ring before apex; wings brownish yellow, with a reduced brown pattern.

Male.—Length about 14–15 mm.; wing 10–11 mm.

Female.—Length about 16 mm.; wing 12 mm.

Rostrum black; palpi brownish black. Antennæ (♂) 20-segmented, the formula being 2+2+11+5; brownish black throughout; longest branch (about flagellar segment 6 or 7) a little more than one-third the flagellum; last branch about twice the segment; terminal segment elongate, about twice the penultimate. In the female, the antennæ are 19-segmented, the formula being 2+2+8+7; scapal segments obscure yellow, the outer half of the second darkened; flagellum black; longest branch (about flagellar segment 5) about twice the segment. Head polished greenish black.

Mesonotum black, the usual three stripes metallic greenish black, conspicuously transversely striolate; scutal lobes similarly metallic green, striolate, the median region more metallic purple; scutellum purplish black; postnotal mediotergite deep greenish black, more coarsely striolate, these longitudinally arranged on posterior half of sclerite. Pleurotergite produced into a conspicuous tubercle, metallic greenish black. Pleura with a dense appressed white pubescence; ventral sternopleurite polished greenish black. Halteres dusky. Legs with the coxæ heavily whitened; trochanters black, the bases narrowly yellow, very restrictedly so on the hind legs; tibiæ black, the posterior tibiæ with a conspicuous ivory-yellow ring shortly before the tips, this annulus nearly twice as wide as the blackened apex, both the membrane and setæ being pale; tarsi black. Wings brownish yellow, cell *Sc* infuscated; dark pattern much reduced, including the stigma and very reduced seams along *Rs* and on anterior cord; veins dark brown. Macrotrichia of radial veins relatively sparse, especially in the male. Venation: *r–m* greatly shortened or lost by approximation of veins; *m–cu* shortly beyond the fork of *M*.

Abdomen polished black, including the hypopygium; basal tergite more metallic blue-black; basal lateral portions of tergites 3 and 4 more brownish black; basal sternites more brownish yellow. Male hypopygium with the median region of the tergite produced into a low rounded tubercle that is directed ventrad. Outer dististyle small, yellowish brown, narrowly pointed at outer end. Inner dististyle a blackened curved rod that narrows gradually to an acute blackened point.

The females that I associate with this species have the black colours of the body replaced by more castaneous, the præscutal stripes and scutal lobes remaining metallic green and being conspicuously striolate. Legs shorter and stouter, the coloration and position of the pale tibial ring as in the male. Abdominal segments chestnut-brown, the extreme bases of the segments yellow, the apices narrowly purple.

Hab. Victoria.

Holotype, ♂, Ben Cairn, near Millgrove, in beech gully, altitude 2900–3200 feet, February 9, 1929 (*F. E. Wilson*).

Allotopotype, ♀.

Paratopotypes, 1 ♂, 1 ♀.

There is a possibility that the female here referred to this species does not belong here.

Gynoplistia (*Gynoplistia*) *erythrina*, sp. n.

Belongs to the *viridithorax* group; general coloration reddish castaneous, the mesonotal præscutum with vague greenish stripes; antennæ (♀) with nine branched segments; femora reddish orange; posterior tibiæ with a broad yellow subterminal ring; wings light yellow with a sparse dark pattern; abdomen reddish, with vague coppery reflexions.

Female.—Length about 16 mm.; wing 14 mm.

Rostrum short, reddish, the nasal region tufted with yellow setæ; palpi yellowish brown, the terminal segments clearer yellow. Antennæ (♀) 19-segmented, the formula being 2+2+7+8; scape obscure yellow, the remaining segments and branches black, the bases of the proximal segments restrictedly paler; longest branch about three times the segment; flagellar segment 9 with the branch subequal to the segment; flagellar segment 10 with only a slight apical swelling; terminal segment constricted at mid-length and evidently formed by the fusion of two segments. Head shiny chestnut-fulvous.

Mesonotal præscutum light chestnut, the usual stripes only poorly differentiated, the median one, especially, with greenish reflexions, the stripes with transverse striolæ as in the group, the median area further elevated into a ridge; remainder of mesonotum reddish chestnut, with evident sculpturing, on the postnotal mediotergite coarser, the cephalic portion with transverse striæ, the remainder of the sclerite with a median furrow and accessory lateral striæ that are long and oblique, the posterior region more nearly smooth. Pleura reddish chestnut, with a sparse grey bloom; dorso-pleural region black; a darkened depressed area on the suture between the anepisternum and pteropleurite; ventral sternopleurite and pleurotergite nitidous. Pleurotergite with the ventral cephalic portion elevated into a conspicuous tubercle, the remainder of the surface with coarse striæ. Halteres fuscous, the knobs brighter, obscure fulvous. Legs with the coxæ reddish chestnut, very sparsely pruinose except at base; trochanters reddish yellow; femora uniformly reddish orange; fore and middle tibiæ yellowish brown, brighter basally, the tips more darkened; posterior tibiæ elongate, yellowish brown, the outer face darker, the tip narrowly infuscated, with a broad pale yellow subterminal ring occupying about one-third the total length of the segment; tarsi relatively short, dark brown; tibial spurs elongate. Wings with a light yellow tinge, the distal half a trifle more infumed; stigma dark brown, very conspicuous; remainder of wing-disk almost clear, with very restricted brown clouds at origin of *Rs* and along the cord; veins dark brown, the posterior prearcular veins light yellow. Venation: *Rs* long, strongly arcuated to feebly angulated at origin; *m–cu* at about one-fifth the length of cell *1st* M_2 and lying proximad of *r–m*.

Abdomen reddish, with vague bronzy or coppery reflexions, the extreme base of tergite 1 deep greenish black; restricted sublateral darkened areas are apparently not normal; sternites even darker and more coppery. Ovipositor with the elongate valves brownish horn-colour, the tips of the tergal valves paler.

Hab. New South Wales.

Holotype, ♀, Mt. Kosciusko, February 11, 1924 (*Nicholson*).

Gynoplistia erythrina is a large striking species that differs notably from all other members of the *viridithorax* group in the almost uniform reddish coloration of the body.

Gynoplistia (*Gynoplistia*) *exornatoides*, sp. n.

Characters very similar to those of *G.* (*G.*) *exornata*, Alexander, of Victoria, (Ann. & Mag. Nat. Hist. ser. 10, vol. iii. pp. 62–63, 1929), differing especially in the details of structure of the male hypopygium.

Male.—Length about 10 mm.; wing 8·8 mm.

Antennæ (♂) 17-segmented, the formula being 2+2+9+4; brownish black throughout; terminal segment about one-half longer than the penultimate. Head metallic blue-green, not paler beneath. Mesonotal scutellum more reddish brown. Abdomen with the basal segment and proximal portion of segment 2 purple, the remainder orange-yellow. Male hypopygium with the basistyle lacking a setiferous lobe at base. Outer dististyle about one-half the length of the inner, elongate-oval, the apex subacute, the surface entirely glabrous. Inner dististyle a yellow, nearly straight rod that narrows to an acute, narrowly blackened tip. Each gonapophysis with a lateral and an apical spine.

Hab. Victoria.

Holotype, ♂, Ben Cairn, near Millgrove, in beech gully, altitude 2900–3200 feet, February 9, 1929 (*F. E. Wilson*).

Gynoplistia (*Gynoplistia*) *zebrata*, sp. n.

General coloration black, the head and pleura pruinose; halteres dark brown; legs chiefly black; wings cream-coloured, with complete, nearly parallel-sided dark cross-bands that are wider than the interspaces; cell M_1 lacking.

Female.—Length about 9 mm.; wing 6·8 mm.

Rostrum and palpi black. Antennæ (♂) 16-segmented, the basal four or five segments pale, the outer segments passing into black; flagellar segments 5 to 7 slightly produced, giving to the segments a triangular appearance. Head black, heavily grey pruinose.

Mesonotum black, shiny, but not highly polished. Pleura black, heavily pruinose. Halteres brownish black throughout. Legs with the coxæ black, pruinose; trochanters dark brown; femora black, the bases narrowly brightened, more extensively so on the fore femora; tibiæ black; tarsi brownish black, the proximal ends of the basitarsi slightly paler. Wings with the ground-colour creamy, with three complete dark brown cross-bands, together with additional dark markings nearer the wing-base; cell *C* entirely dark brown; cell *Sc* a little paler; first dark band at level of origin of *Rs*; second band at cord, completely darkening cell *1st* M_2, both of these bands of approximately equal width and broader than the pale interspace; third dark band including the broad apex; in addition, the bases of cells *R* and *M* extensively darkened, together with more than the distal half of cell *2nd A*; veins dark brown, a little paler in the ground-colour. Venation: cell M_1 lacking; cell *1st* M_2 small, short-rectangular, *m–cu* close to mid-length.

Abdomen black, shiny, the genital segment more pruinose. Ovipositor very elongate, the valves horn-yellow.

Hab. Victoria.

Holotype, ♀, Ban Cairn, near Millgrove, in beech gully, altitude 2900–3200 feet, February 9, 1929 (*F. E. Wilson*).

Gynoplistia zebrata is allied to *G.* (*G.*) *leai* (Alexander), differing most conspicuously in the wing-pattern and uniformly darkened halteres.

Gynoplistia (*Gynoplistia*) *distinctissima*, sp. n.

General coloration of mesonotum polished black, the disk and scutal lobes castaneous; antennæ (♂) 17-segmented, with ten branched segments; halteres yellow; wings subhyaline, with a sparse dark brown pattern; cell M_1 lacking.

Male.—Length about 5·5–5·7 mm.; wing 6·5–6·7 mm.

Rostrum obscure yellow; palpi black. Antennæ (♂) 17-segmented, the formula being 2+2+8+5; scapal segments pale brown, the flagellum and branches black; longest branch (about flagellar segment 4 or 5) nearly one-half the length of the flagellum; last branch subequal to the segment; terminal segment about one-half longer than the penultimate. Head with the disk of the vertex polished black, the anterior vertex and orbits yellowish.

Pronotum black. Mesonotal præscutum polished black in front and laterally, the usual stripes castaneous, confluent, the lateral ones crossing the suture on to the scutal lobes; scutellum obscure yellow, darker medially; postnotal mediotergite obscure brownish yellow, extensively blackened medially. Pleura black, the anepisternum, pteropleurite, and meral region with a dense silvery pubescence. Halteres pale yellow. Legs with the coxæ and trochanters pale, the former silvery pruinose; femora obscure brownish yellow, in cases with a more or less distinct subterminal darker ring; tibiæ and tarsi brownish black to black, the posterior legs paler, tipped with dark. Wings subhyaline, the apex broadly pale brown, this very indistinct and sometimes obliterated; a restricted dark brown pattern, including a circular spot at origin of *Rs* and a narrow seam extending along the anterior cord, confluent with the stigma; narrower and barely evident seams on posterior cord and outer end of cell 1*st* M_2; prearcular cells restrictedly yellowish; veins black, the prearcular veins yellow. Venation: *Rs* angulated and weakly spurred at origin; cell M_1 lacking; cell 1*st* M_2 small, widest at base; *m–cu* at from one-third to one-half the length of the cell.

Abdomen with the basal tergites blackened, the succeeding segments obscure yellow, restrictedly variegated laterally with darker, the surface with vague metallic reflexions; a subterminal shiny black ring; hypopygium yellow. Male hypopygium with the caudal margin of the tergite produced into two tubercles, separated from one another by a broad U-shaped notch. Basistyle stout, the mesal face at base with a dense cushion of long erect yellow setæ; apex of style produced into a flesh lobe. A single dististyle, yellow, broadest at base, narrowed to the gently curved, acute, blackened apex. Gonapophyses appearing as long slender pale blades that narrow to acute points. Ædeagus long, straight, subtended by narrow lateral flanges, the tip simple.

Hab. Victoria.

Holotype, ♂, Ben Cairn, near Millgrove, in beech gully, altitude 2900–3200 feet, February 9, 1929 (*F. E. Wilson*).

Gynoplistia distinctissima is very different from the other Australian species of the genus in which cell M_1 is lacking.

XIII.—*Some Coal Measure Arthropods from the South Wales Coalfield.* By EMILY DIX, M.Sc., F.G.S., and JOHN PRINGLE, F.G.S.

IN a recently published paper [*] we gave an account of all the fossil Xiphosura known to have been collected from the Coal Measures of South Wales, and from the specimens which came under our review we described a number of new species. While our paper was passing through the press, however, Mr. W. D. Ware, of Ystradgynlais, a keen and enthusiastic collector, obtained no fewer than eight specimens from shales excavated during sinkings at the Cefn Coed Colliery, near Neath. In addition, another specimen has been forwarded to us by Dr. F. J. North of the National Museum of Wales, which was collected by Mr. W. O'Connor, F.G.S., from the Six Feet Seam at Gelli Colliery, Rhondda. Mr. J. H. Davies, F.G.S., has also kindly lent us a specimen which he found in shales from the roof of the Harnlo Seam at Ystalyfera. In this communication, therefore, we propose to describe this new material, and also other species of Arthropods.

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[*] E. Dix and J. Pringle, "On the Fossil Xiphosura from the South Wales Coalfield, with a Note on the Myriapod *Euphoberia*," Summary of Progress of the Geological Survey for 1928, pt. ii. pp. 90–114 (1929).

The Belinurids collected by Mr. W. D. Ware were found in the Lower Coal Series, in the measures lying between the Cornish Vein and the Red Vein (Similis and Pulchra Zones of Messrs. Davies and Trueman's scheme of classification). Several of the specimens were obtained from a bed of shale 125 yards below the Red Vein and above the marine band which occupies a position near the middle of the Pulchra Zone, and were associated with a species of *Euestheria*. It is of interest to note that at Cwmgorse, which lies about six miles to the west of Cefn Coed, examples of Belinurids, including identical species, were found at a corresponding horizon; at neither of these localities have specimens of *Prestwichianella* and *Euproops* been recorded.

Belinurus morgani, sp. n. (Fig. 1.)

This interesting specimen was collected from the roof of the Cornish Vein, which was passed through at a depth of 729 yards in No. 1 Pit at Cefn Coed. It was found in a bluish-black shale in association with freshwater shells. The specimen is fairly well preserved, and is complete except for the telson.

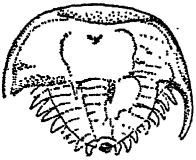
Dimensions :—

	mm.
Length of prosoma	4·5
Breadth of prosoma	11
Length of genal spine (preserved)	3
Estimated length of glabella	3
Breadth of glabella	4·1
Length of thoracetron	9
Estimated breadth of axis of thoracetron	2

The prosoma is more than twice as broad as long, and along the anterior margin it is almost straight, gently curving backwards into long genal spines which are almost parallel to the margin of the thoracetron. Around the cephalon is a narrow flattened border, which is more than a millimetre wide on the centre of the anterior margin, where it forms a well-marked doublure. The border is covered with distinct small granules.

The glabella is not well preserved; the two lobes can be detected, but the position of the eyes cannot be seen. On the left side the lateral line of the lobe is produced into a long neck-spine. The thoracetron is semicircular in shape and is made up of a number of segments. The mesosoma consists of seven segments, each being terminated in long, slightly recurved spines. The axis of the thoracetron is poorly preserved, but it appears to be narrow in proportion to the width of the mesosoma. The metasoma is made up of two fused segments, and two small spines are seen on either side of the caudal area. The telson is not preserved.

Fig. 1.



Belinurus morgani, sp. n. × 2½.

The specimen most closely resembles *B. arcuatus*, Baily, in the shape of the cephalon and in the presence of neck-spines. It differs from that species, however, in having a broader cephalon with a narrow granulated border which widens towards the centre, forming a well-marked doublure, and in the possession of a larger thoracetron.

The holotype of *B. morgani* is now in the collections of the Museum of Practical Geology, and is registered No. 49362.

Belinurus cf. *truemani*, Dix & Pringle. (Fig. 2.)

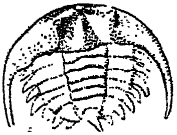
Another interesting specimen was obtained from bluish-black shale 125 yards below the Red Vein in No. 2 Pit at the Cefn Coed Colliery. It was associated with numerous examples of *Euestheria*, and is well preserved, being an almost complete positive impression.

Dimensions:—

	mm.
Breadth of prosoma	7·5
Length of prosoma	2·5
Length of prosoma and thoracetron	6
Length of glabella, nearly	2·5
Breadth of glabella	2·75
Length of genal spine	2·5
Breadth of thoracetron at anterior margin	5·25

In general form it is almost circular with a convex axis. The prosoma is three times as broad as long, and is surrounded by a narrow flattened margin ending in genal spines. The glabella is large, fairly well marked, and appears to extend almost to the anterior margin of the prosoma. It is divided into lobes by means of a median ridge, which is prominent in front, but becomes flattened posteriorly. The lateral eyes are situated on the ophthalmic lines near the anterior margin.

Fig. 2.



Belinurus cf. *truemani*, Dix & Pringle. × 2½.

The mesosoma is made up of five segments which terminate as small, blunt, slightly curved spines. The axis is well-marked, and is broad, decreasing little in width towards the telson. The metasoma is small, consisting of two, possibly three, fused segments. On the centre of the caudal area is a distinct tubercle which marks the base of the telson. The length of the telson is unknown.

The specimen closely resembles *B. truemani*, Dix & Pringle, particularly in the shape of the prosoma and in the possession of a glabella, which is large in relation to the prosoma. In these characters *B. truemani*, Dix & Pringle, differs from all other species of *Belinurus*. Measurements of our specimen, however, show the prosoma and thoracetron to be slightly larger than the holotype, but we do not regard this difference as of significance, and certainly would not justify us in regarding it as a new species. This specimen affords particularly useful information concerning the thoracetron, which is not well preserved in the holotype.

It is interesting to note that this specimen, like the holotype of *B. truemani* *, was found near the middle of the Pulchra Zone.

The specimen has been presented to the Geological Department, National Museum of Wales, and is registered No. 30.46. G 2.

Belinurus bellulus, König. (Fig. 3.)

The specimen figured below was obtained from shales at a depth of 578 yards, and about 145 yards below the Red Vein in No. 1 Pit, at Cefn Coed. It is complete except for a

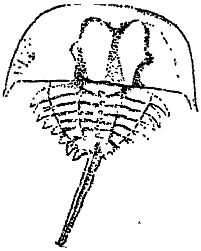
* E. Dix and J. Pringle, *ibid.* p. 94.

portion of a genal spine and a part of the telson, and measures as follows:—

	mm.
Length of prosoma	2·8
Breadth of prosoma	7·8
Length of thoracetron	3·25
Breadth of axis of thoracetron	1
Breadth of thoracetron minus spines	4·5
Length of glabella	2
Breadth of glabella	2
Length of telson preserved	4·5

As in the holotype of *B. bellulus*, König, the breadth of the prosoma is more than twice its length, and at the posterior angles of the cephalon are two long genal spines. In our specimen the glabella is well preserved, and is divided into two lobes by a median ridge which becomes slightly flattened near the posterior margin of the cephalon. The lines surrounding the lobes of the glabella are doubly arched in front, making a distinct V. Two well-marked curves on these lines indicate the position of the lateral eyes, and the position of the median eye can be seen in the V in front of the glabella.

Fig. 3.



Belinurus bellulus, König. × 3½.

The characters of the thoracetron are typical of those of *B. bellulus*, König.

This specimen is now in the collections of the Museum of Practical Geology, and is registered No. 39363.

Another specimen closely related to *B. bellulus*, König, was found in the same pit at Cefn Coed, but at the slightly lower depth of 580 yards, and associated with it was the fragment of *B. reginæ*, Baily, referred to on p. 141. The specimen is well preserved, and is complete except for a small portion of a genal spine. While it closely resembles König's species in most of its characters, the prosoma is somewhat larger and more rounded and the thoracetron is slightly pointed at the posterior end.

This specimen has been presented to the Museum of

Belinurus konigianus, Woodward.

A specimen, which we think probably belongs to this species, was collected by Mr. W. O'Connor, F.G.S., from the roof of the Six Feet Seam at Gelli Colliery, Rhondda. It shows a fairly well preserved cephalon and the greater portion of the thoracetron; it is moulded on an ironstone nodule founded in a bluish-black shale.

The specimen resembles *B. konigianus*, Woodward, in most characters, but the prosoma seems to be slightly broader than that of the type. The genal angles are not clearly seen, but there appears to be no genal spines present. As in Woodward's species, the thoracetron is broad in relation to the prosoma, and it also shows the broad axis. The pleuræ are not well preserved and the telson is not present.

Belinurus reginæ, Baily.

Two examples of this species were obtained from bluish-black shales passed through in the No. 1 Pit at Cefn Coed at the depths of 577 yards and 580 yards respectively, and about 145 yards below the Red Vein. They are well preserved, and are complete with the exception of the telson. They are of interest since they constitute the first definite record of the species from South Wales.

In the same bed of shale at 580 yards a third specimen was found in association with *B. bellulus*, Baily, described on p. 139, and, although incomplete, the characters of the fragment are clearly those of *B. reginæ*, Baily.

These specimens have been presented to the Museum of Practical Geology, and are registered No. 49365–7.

With *B. reginæ*, Baily, also we suggest comparison of an incomplete example collected from the roof of the Cornish Vein at Cefn Coed. The specimen represents the greater portion of the cephalon and thoracetron, and is preserved in a bluish-black shale in association with freshwater shells. In the general shape of the cephalon and the proportions of the thoracetron, it closely resembles Baily's figured specimen.

Another incomplete specimen was collected by Mr. J. H. Davies, F.G.S., from the roof of the Harnlo Vein at Ystalyfera; associated with it were freshwater shells, including *Naiadites* sp. The characters of the head-shield and thoracetron preserved in this specimen suggest affinities with those of *B. reginæ*, Baily.

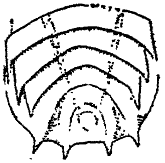
Belinurus sp.

Mention should be made of a rather poorly preserved specimen as a record of the occurrence of *Belinurus* in shales associated with the Soap Vein at Cefn Coed. This horizon, which contains numerous freshwater shells, has hitherto not yielded examples of the genus. The species, however, cannot be determined.

Eophrynus warei, sp. n. (Fig. 4.)

A rare arthropod was collected by one of the writers (E. D.) in dark blue shale from the roof of Six Feet Seam at Garngoch Colliery, near Swansea. Associated with it were numerous plant-remains and abundant freshwater shells, including *Anthracomya tenuis*, Davies & Trueman, and *A. phillipsii* (Will.).

Fig. 4.



Eophrynus warei, sp. n. × 3.

Only one species of the genus *Eophrynus* (*E. prestvicii*, Buckland) has hitherto been recorded in Britain, and a fine example was obtained by one of us (J. P.) from the shales overlying the Graigola Seam at Clydach, near Swansea. The specimen known as *E. salmi*, Stur, from the Coal Measures of Silesia, has more recently been chosen as the genotype of *Stenotrogulus*, Fritsch, while *E. carbonis* has been referred to the genus *Brachypyge*. The present specimen differs in important characters from *E. prestvicii*, and although it is incomplete it appears to be desirable to describe it as a new species.

Dimensions :—

	mm.
Length of opisthosoma, preserved	6
Breadth of opisthosoma	6
Breadth of axis of opisthosoma, near posterior end	2·2

The specimen shows only the ventral surface of the opisthosoma (abdomen). In shape it is somewhat quadrangular with a rounded posterior border. It expands very slightly towards the fifth and sixth somites, behind which the border is almost semicircular.

The posterior border of each somite is clearly shown, and is distinctly curved, the seventh and eighth being almost curved through a semicircle. Each of the fourth, fifth, and sixth segments bears a pair of lateral spines, which are strong and almost straight. The spines of the fourth segment are close to the border of the opisthosoma, but those of the fifth and sixth segments are situated farther from the border.

The seventh and eighth segments terminate in sharp spines which pass beyond the borders of the opisthosoma. A small ninth segment can be detected, but the specimen does not clearly show the area around the anal plate.

The axis is broad, but only feebly marked. The specimen appears to be covered by fine granules, but shows no large tubercles.

The opisthosoma of this specimen differs from that of *E. prestvicii* (Buckland) in its much smaller size, and in its more elongate form. It also differs in the presence of distinct spines on the fourth, fifth, and sixth segments, and in the absence of definite tubercles.

The specimen, the holotype of the species, has been presented to the Geological Department, National Museum of Wales, and is registered No. 30. 41. G1.

Pygocephalus cf. *cooperi*, Huxley.

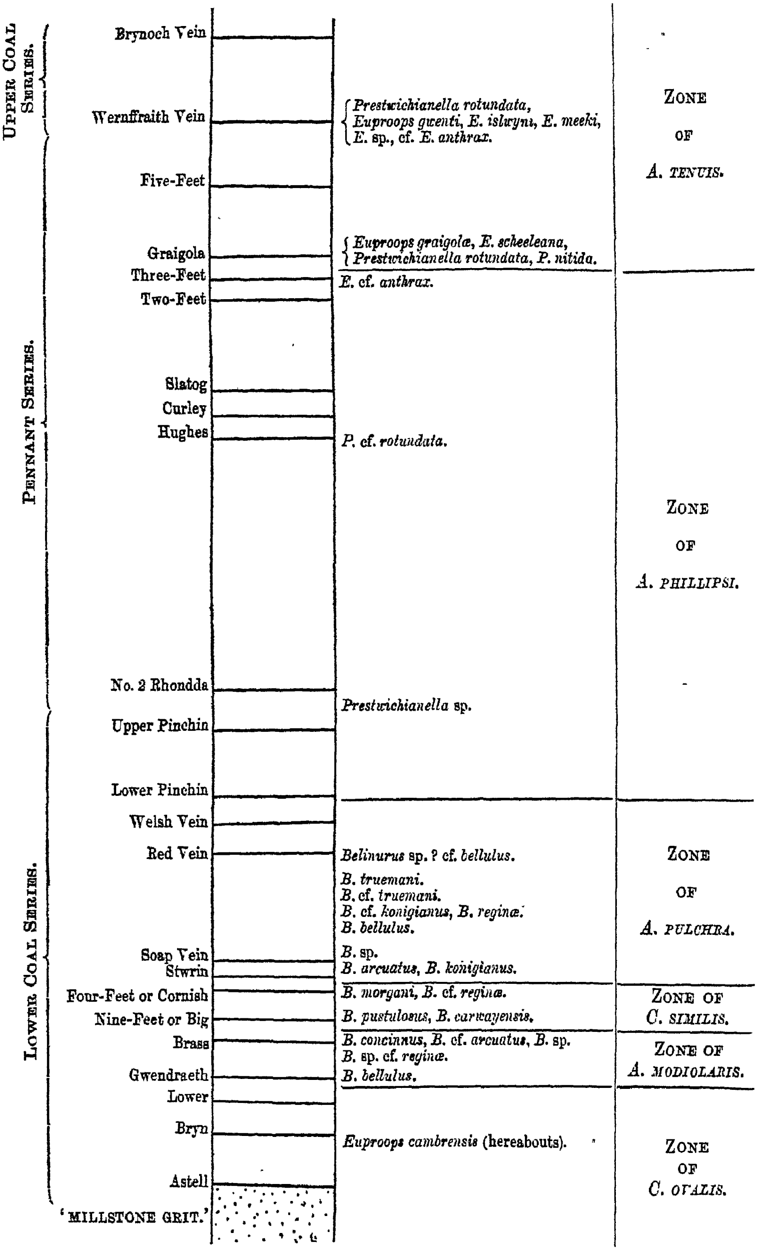
Another interesting arthropod which has been recorded from other coalfields in this country was collected many years ago by one of the writers (J. P.) in grey shales from the roof of the Mynyddislwyn Seam at Gellideg, Monmouthshire. Associated with it were numerous plant-remains and several other arthropods, including *Euproops gwenti*, Dix & Pringle, *E. islwyni*, Dix & Pringle, *Prestwichianella* sp., and *Archimylacris* sp.

Unfortunately the specimen is incomplete, but it shows the greater portion of the ventral surface of the thorax of a male specimen. The seven thoracic sternites are well seen, and the position of the two antennæ can be determined. In these characters it resembles the male specimen of *Pygocephalus cooperi*, Huxley.

This specimen is now in the collections of the Museum of Practical Geology, and is registered No. 25421.

In conclusion, we tender our thanks to Dr. W. D. Lang, F.R.S., and to Mr. T. H. Withers, of the British Museum (Natural History), for allowing us access to the collections of Coal Measure Arthropods in their care. We also wish to express our indebtedness to the Officers in charge of the Museum of Practical Geology; to Dr. F. J. North and to Mr. J. H. Davies for the loan of specimens; and especially to Mr. W. D. Ware for submitting to us his fine collection of Belinurids from the Cefn Coed Colliery. We have again to thank Dr. A. E. Trueman for his helpful criticism of this paper during its preparation.

Table showing the Distribution of Belinurus, Euproops, *and* Prestwichianella *in South Wales.*



Vertical scale: 1 inch to approximately 1000 feet.

XIV.—*A new Subspecies of Eriophyid Mite on Plum.*

By A. M. MASSEE, The Research Station, East Malling.

A SPECIES of gall mite which makes a very striking gall on the leaves of the cultivated plum was sent for determination to East Malling in September 1928 and in April 1929 by Mr. Arthur Gibson, Dominion Entomologist, Ottawa, Canada. The galls were found on plum leaves by Professor A. V. Mitchener, of the Manitoba Agricultural College, Winnipeg, Manitoba.

The gall produced by the mite is very characteristic and is unlike any of the other known galls of plum produced by Eriophyid mites. The gall is a typical cephaloneon or "pouch-shaped" gall, and is somewhat similar to the "nail gall" of lime produced by the mite *Eriophyes tiliæ* (Pgst.), Nal.

The following description of the gall is made from material preserved in spirit and from a number of dried-up galls.

The galls are always to be found on the under surface of the leaves, with the small entrance to the galls on the upper surfaces of the foliage. The openings are covered with pubescence and by numerous fine yellow hairs. The galls are usually found in quantity, seventeen or more being present on one leaf. The average length of the galls is half an inch, sometimes longer and frequently shorter, and they are somewhat more slender towards the base.

Frequently only one gall occurs on a single leaf. Their colour is pale green to yellowish, tinged with red. When fully mature they turn dark brown. When dry they become blackish, and very brittle.

The cause of these galls proved to be a species of mite of the genus *Eriophyes*, and very closely related to the plum gall mite of Europe, namely, *Eriophyes similis*, Nal.

Before describing the mite the writer sent some material to Dr. A. Nalepa, of Vienna, in order to obtain his opinion regarding the mite, and to ascertain whether Nalepa considered the mite to be a subspecies of *E. similis*, Nal.

Dr. Nalepa* replied as follows :—"The gall mite from the plum tree is closely allied with *E. similis*, Nal. (and undoubtedly a subspecies of it), though one would expect with regard to its gall formation to be closely related to another plum gall mite—*E. padi*, Nal. You must publish an exact description of the mite."

The new mite differs from *E. similis*, Nal., in many respects. The sides of the thoracic shield are smooth, the feathered claw is 4-rayed and the dorsum and venter of the abdomen strongly punctate. It is proposed to name this new subspecies *Eriophyes similis prunianus*, subsp. n.

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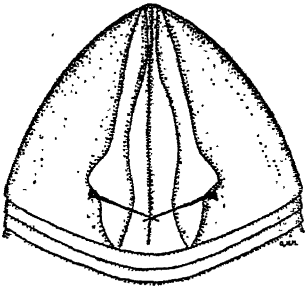
* This letter was received a few days before Nalepa's death.

The subspecies is fully described below, together with localities, host-plants, etc.

In addition, a detailed description of *E. similis*, Nal., is appended for reference purposes.

The type-vial will be deposited in the Canadian National Collection.

The writer is greatly indebted to Mr. A. Gibson for his kind assistance in connection with this work.



Dorsal view of cephalothoracic shield of *Eriophyes similis prunianus*, subsp. n.

Eriophyes similis prunianus, subsp. n.

Body drawn out, cylindrical, tapering at base. Thoracic shield triangular, 34 μ long. Shield ornamented by five longitudinal furrows in middle as shown in text-figure. Lateral margins of shield smooth. Thoracic bristles situated at some distance from posterior margin of shield, moderately widely separated. Bristles weak, directed towards each other, 16 μ long. Warts of thoracic bristles very conspicuous.

Rostrum short and stumpy, almost covered by thoracic shield, 18 μ long. Legs small and frail. First pair of legs 28 μ long, fourth and fifth joints 12 μ long; second pair 26 μ long, fourth and fifth joints 10 μ long. Tarsal bristles 20 μ long. Claws of second pair of legs stout, strongly curved, 10 μ long; claws of first pair 9 μ long. Feathered claw large, well developed, 8 μ long, 4-rayed.

Sternal ledge forked, not well defined. First pair of coxal bristles weak, before anterior end of sternal ledge; second pair stout, acuminate, a little before posterior end of sternal ledge, 20 μ long; third pair acuminate, in line with inner coxal angle, stout, 50 μ long.

Abdomen broadly ringed, there being about 48 rings. Dorsum and venter strongly punctate. Lateral bristles strongly acuminate, 26 μ long. First pair of ventral bristles strongly acuminate, 44 μ long; second pair very frail and indistinct, 5 μ long; third pair 24 μ long. Anal lobe well formed, distinct, smooth, 12 μ broad. Caudal bristles thread-like. Accessory bristles absent. Epigynium basin-shaped, somewhat flattened, 20 μ broad. Cover-flap smooth. Genital bristles 14 μ long, situated in line with base of epigynium.

♀. 180 μ long, 46 μ broad. ♂ unknown.

Host-plant.—*Prunus domestica*, L. Cultivated plum. Conspicuous cephaloneon or "pouch-shaped" galls on the under surfaces of plum leaves. The galls sometimes attain the length of half an inch, and as many as seventeen or more galls occur on a single leaf. In appearance the galls resemble the "nail gall" of lime.

Distribution. — Winnipeg, Canada (*Professor A. V. Mitchener*).

Eriophyes similis, Nal.

Nalepa, Anz. Akad. Wien, 1889, v. 26, p. 162.

Body drawn out, cylindrical. Thoracic shield triangular, 38 μ long. Head inclined from base. Shield ornamented by a number of longitudinal furrows. The central furrow is almost straight and stretches from apex to posterior margin. Two curved longitudinal furrows are situated on either side of median furrow, widely separated at base and converging towards apex. Furrows at lateral margins not conspicuous, numerous, branched. Thoracic bristles situated at some distance from posterior margin of shield, not widely separated. The bristles are weak, directed upwards and inclined inwards, 18 μ long. Warts of thoracic bristles plicated, not conspicuous.

Rostrum short and stout, 19 μ long. Legs small, distinctly articulated, fourth and fifth joints weaker than preceding joints; first pair of legs 32 μ long, fourth and fifth joints 15 μ long; second pair 28 μ long, fourth and fifth joints 13 μ long. Tibial setæ of first pair long, projecting from a large tubercle. Claws of second pair of legs 9·5 μ long; claws of first pair very slightly shorter. Feathered claw large, feather-like, 5-rayed.

Sternal ledge forked, prongs of fork small and straight. First pair of coxal bristles short and situated at some little distance from anterior end of sternal ledge; second pair at some distance from the inner coxal angle and from the fork of sternal ledge.

Abdomen broadly ringed—there being about 52 rings, which are equidistant. Lateral bristles in line with posterior margin of epigynium, 28 μ long. The ventral bristles are extremely fine and their length is difficult to define. First pair of ventral bristles 45 μ long, second pair 15 μ long, third pair 28 μ long, hair-like at apex. Anal lobe small. Caudal bristles thread-like. Accessory bristles absent. Epigynium basin-shaped, somewhat flattened, 25 μ broad. Cover-flap smooth. Genital bristles 15 μ long, stiff, situated at base of epigynium. Epiandrium 21 μ broad, arch-like.

♀. 200 μ long, 38 μ broad. ♂. 160 μ long, 37 μ broad.

Host-plant.—*Prunus domestica*, L. Cephaloneon or "pouch-shaped" galls on the under surfaces of the leaves, occasionally on the upper surfaces of leaves also. The openings of galls from one to three millimetres, hairy.

Distribution.—England, Italy, Crimea, Finland, Warsaw, and Sicily.

XV.—*On the Generic Position of Two Species of Hemiptera described by W. L. Distant.* By A. N. Kiritshenko.

Distant has described and figured (Biol. Centr.-Amer., Ins., Rhyn. Hemipt.-Heteropt. i. 1881, p. 168, tab. xv. fig. 19) as *Harmostes propinquus*, Dist. (Coreidæ), a new species undoubtedly belonging to the genus *Aufeius*, Stål. This species is known to me from a specimen taken in the vicinity of Mexico City.

In 1904 he described (Faun. Brit. Ind., Rhyn. ii. p. 396) a new genus *Rulandus*, Dist., which he attributed to the family Nabidæ (according to his nomenclature, subfamily Nabidinæ, division Prostemmaria). The genotype was described some lines below (*loc. cit.* pp. 396–397) and figured (fig. 253) as *Rulandus phædrus*, Dist. This figure later enabled Kirkaldy ('Canadian Entomologist,' xxxix. 1907, p. 229) to point out more correctly the systematic position of the genus, and he referred it to the family Reduviidæ, subfamily Acanthaspidinæ.

I have now had the opportunity of studying a specimen of *Rulandus phædrus*, Dist., from the original type-locality, Rangoon, received by the Zoological Museum of the Academy of Science, U.S.S.R., from the original collector Mr. L. Fea. This study has enabled me to confirm Kirkaldy's opinion as to the systematic position of the genus *Rulandus*, Dist., in the family Reduviidæ, but Kirkaldy was wrong in attributing it to the subfamily Acanthaspidinæ. Actually it belongs to the subfamily Salyvatinæ.

XVI.—*Some Additions to the Collembola of Britain.*

By H. WOMERSLEY, A.L.S., F.E.S.

THE following Collembola, either new to science or new to our British lists, have recently passed through my hands. The species are:—

Hypogastrura vernalis, Carl.
Paratullbergia concolor, gen. et sp. n.
Isotoma viridis, f. *cincta*, Tlbg.
Lepidocyrtus vespensis, sp. n.
Pseudosinella martelli, Carpenter.
Sminthurides signata, Krausbr.
Sminthurinus igniceps, f. *trinotata*, Axels.

Family **Poduridæ**, Lubb.

Subfamily *HYPOGASTRURINÆ*, Börner.

Genus HYPOGASTRURA, Bourl., Börner.

Hypogastrura vernalis, Carl. (Figs. 1–2.)

This is a well-known European form, but does not appear to have been previously recorded from this country.

A large number of specimens were found along with *Arrhopalites cæcus*, Tlbg., infesting decayed tulip-bulbs in the Entomological Dept. of the Imperial College, South Kensington, Feb. 1930. The bulbs came from Wimborne, Dorset, which probably is the real locality.

Subfamily *ONYCHIURINÆ*, Börner.

Genus PARATULLBERGIA, nov. (Figs. 3–10.)

This genus is closely allied to *Tullbergia* and *Onychiurus*, but differs markedly in the structure of the sensory organ on the third antennal joint, as well as in the characteristic form of the organs corresponding to the pseudocelli on the body-segments of these genera. The solitary specimen on which this genus and species is founded was taken under loose bark on a rotten log in Epping Forest, near Loughton, 26/3/30.

Diagnosis of Genus.—Facies as in *Tullbergia*. Eyes

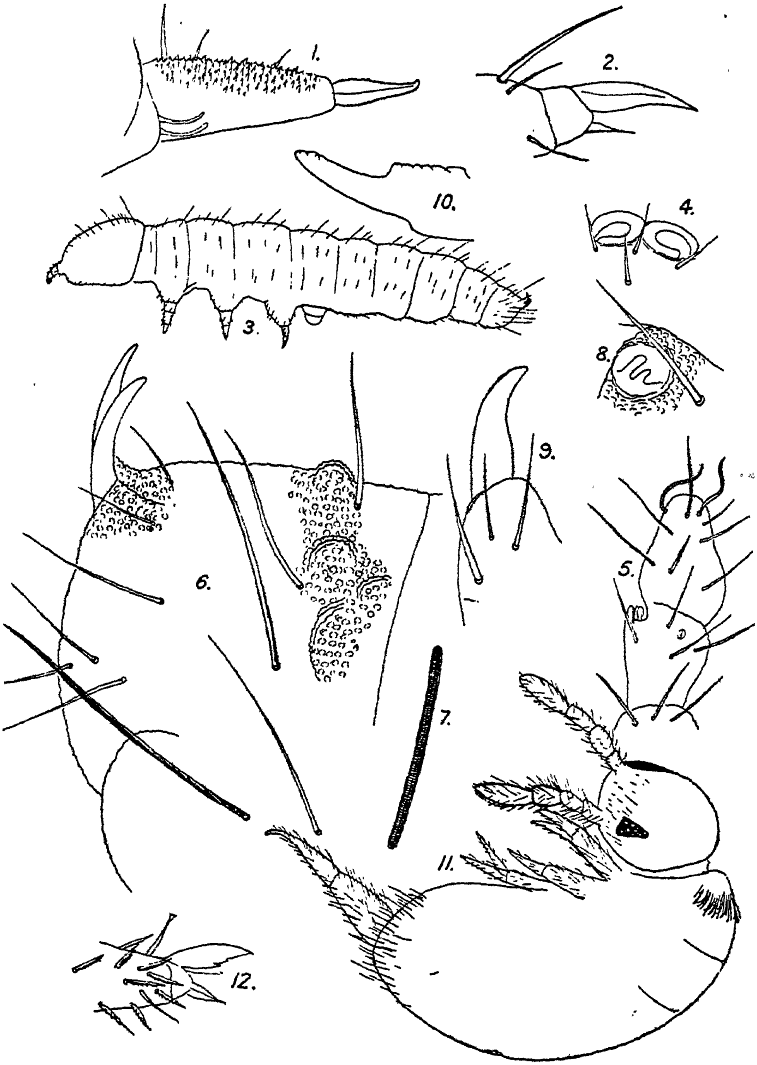


Fig. 1.—*Hypogastrura vernalis*, Carl. Dens and mucro.
Fig. 2.—Ditto. Claw.
Fig. 3.—*Paratullbergia concolor*, gen. et sp. n. Side view of insect.
Fig. 4.—Ditto. Sensory organ of ant. iii.
Fig. 5.—Ditto. Ant. iii. and iv.
Fig. 6.—Ditto. Anal segments.
Fig. 7.—Ditto. Postant. organ.
Fig. 8.—Ditto. Sensory organ on body-segments.
Fig. 9.—Ditto. Claw.
Fig. 10.—Ditto. Mandible.
Fig. 11.—*Lepidocyrtus vespensis*, sp. n. Side view of insect.
Fig. 12.—*Pseudosinella martelli*, Carpenter. Claw.

wanting. Antennæ much shorter than head diag., four-jointed. Ant. iii. with a sensory organ of characteristic form consisting of two large papillæ, each in a separate but adjacent cavity and bent towards each other, the two pockets lie within a deep fold of the outer antennal wall, and the whole is guarded by three setæ (figs. 4–5). Antennæ, joint iv. apically with two long doubly bent sensory rods (fig. 5). Postantennal organ (fig. 7) long and narrow with 60–80 minute lobes, within an elongate groove.

Organs apparently corresponding to the pseudocelli of *Tullbergia* and *Onychiurus* are present as follows: ant. base 1+1, abd. i. 1+1, ii.?, iii.?, iv. 1+1, v. 1+1, those on abdominal segments are placed postero-laterally. These organs (fig. 8) consist of a smaller and a larger slightly curved lobe lying within a circular cavity. Abdom. vi. with 5–6 large tubercles (fig. 6). Anal horns present, two, large and strongly curved. Furca entirely wanting. Lower claw wanting, upper claw strong and simple without inner teeth. Clavate hair on tibio-tarsus wanting (fig. 9). Mandibles (fig. 10) strong with four blunt teeth and well-developed molar area. Clothing of long and strong setæ.

Paratullbergia concolor, sp. n.

Diagnosis.—Size 1·08 mm. Colour uniformly light brown. Ant. shorter than head diag., joints relatively 1 : 1 : 1 : 1¼. Ratio of length of anal horns to hind claw = 4 : 3. Colour of anal horns much darker than that of body. Cuticle generally rugose. Setæ long and strong. Other details as for the genus.

Type, in British Museum.

Family **Entomobryidæ**, Töm.

Subfamily *ISOTOMINÆ*, Schffr., Börner.

Genus ISOTOMA, Bourl.

Isotoma viridis f. *cincta*, Tlbg.

This distinct variety has not been recorded before from this country. I was fortunate in meeting with several specimens in the propagating houses at Kew Gardens, 12/3/30.

Subfamily *ENTOMOBRYINÆ*, Schffr., Borner.

Genus LEPIDOCYRTUS, Bourl.

Lepidocyrtus vespensis, sp. n.

Diagnosis.—Size 0·79 mm. Colour light, except for the scaling which gives it a delicate brownish appearance, eye-patches blue-black. Antennæ, legs, and furca colourless except for a slight brownish tinge.

Moderately scaled, with delicate rounded scales. Mesonotum with a thick collar of hairs.

General facies of the genus, but mesonotum only slightly overhanging the head. Antennæ slightly longer than head diag., joints relatively 1 : 2 : 2 : 3½. Eyes 8+8 on bluish patches.

Legs normal. Claws as in genus, inner teeth of upper claw?, lower claw lanceolate, clavate tenent hair?. Legs clothed with long and strong setæ.

Furca short and stout, not reaching beyond anterior margin on abd. iii., manubrium : mucrodens = 6 : 5, dentes broad basally, rapidly tapering. Mucro with two teeth and basal spine.

This species is definitely distinguished from the other Lepidocyrti by the colour and the remarkably short furca. Three specimens were present in a number of Collembola sent me by Dr. O. W. Richards, and taken on the comb and in the cavity of a nest of *Vesper germanica*, F., at Slough, Bucks, 31/10/29.

Genus PSEUDOSINELLA, Schffr.

Pseudosinella martelli, Carp.

This species was first described by Dr. Carpenter from Ireland in 1895 as *Cyphoderus martelli*. Almost immediately afterwards it was submitted to Dr. Moniez, who considered it to be synonymous with his *Sira cavernarum* (1893). Since then it has been recorded from many parts of England under the name of *Lepidocyrtus cavernarum*, Mz.

In 1924, however, Denis revised this group of the older genus *Lepidocyrtus*, and his results have been followed by Dr. Handschin, 1929. According to these two authorities, *martelli*, Carp., and *cavernarum*, Monz., are not identical. The first species, in addition to the two large basal wing-like teeth on the inside of the upper claw, possesses another single tooth just above. This accessory tooth is said not to be present in Moniez's species.

The majority of the Collembola taken by Dr. Richards in the Vespa nest were the species now regarded as *martelli*, Carp. Following this identification, I made a re-examination of all my material, and without exception all my records of *cavernarum*, Mz., must be considered to be *martelli*, Carp. In all probability, most British records should be redetermined.

It is of interest to find this and the previous species attached to wasps' nests, and a detailed study of the fauna of hymenopterous nests would probably be as fruitful as with ants. If *Pseudosinella* (*Lepidocyrtus*) *cavernarum*, Mz., recorded as occurring in the nests of various species of ants, is really the species discussed here, then it affords another instance of the same insect inhabiting the nests of both ants and wasps. On this point Dr. Richards writes : "The occurrence in wasps' nests of insects usually found in those of ants is by no means unprecedented. *Oxypoda vittata*, Maerk. (Staphylinidæ), is normally found in the nests of *Acanthomyops fuliginosus*, L., but I found it in the nests of *Vesper vulgaris*, L., at Oxshott, Surrey. In the same nest were found specimens of *Leptocera* (*Limosina*) *claviventris*, Strobl. (Borboridæ), a fly which Mr. Donisthorpe has also taken with *A. fuliginosus*. From the nest of *Vesper vulgaris*, Tuck (Ent. Mo. Mag. xxxii. 1896, p. 153) records *Myrmedonia limbata*, Pk. This Staphylinid is also normally found associating with ants."

Family **Sminthuridæ**, Lubb.

Subfamily *SMINTHURIDINÆ*, Börner.

Genus SMINTHURIDES, Börner.

Sminthurides signatus, Krausbr.

Of this species, I took a single specimen on the side of a plant-pot in Kew Gardens, 12/3/30, along with many *Arrhopalites cæcus*, Tlbg.

Genus SMINTHURINUS, Börner.

Sminthurinus igniceps, f. *trinotata*, Axels.

This pretty and distinctive variety, easily recognised by the small lateral white spots on the abdomen and a third on the head, occurred on plant-pots in a greenhouse at Farnham Royal, 4/3/30, and again in similar habitat at Kew, 12/3/30.

XVII.—*A Note on* Evermannella atrata atlantica, *Parr, the Genus* Coccorella, *Roule, and the Classification of the Iniomi.*

By ALBERT EIDE PARR, Bingham Oceanographic Foundation, Yale University.

IN a recent publication (Bull. Inst. Oceanogr. no. 546, Monaco, November 1929) on some eastern deep-sea fishes, Mr. Louis Roule introduces as a new subspecies of *Evermannella atrata*, Alcock, a form which has been described and figured by the present writer, in a perfectly concordant manner, already in 1928 (Bull. Bingham Oceanogr. Coll. vol. iii. art. 3, December 1928), and, by an odd coincidence, with the use of exactly the same subspecific designation as the one now proposed by Roule as presumably new (viz., subspecies *atlantica*). For *Evermannella* (= *Coccorella*, Roule) *atrata atlantica*, Roule, 1929, one should therefore read *Evermannella atrata atlantica*, Parr, 1928. Roule's unfamiliarity with the contents of the just-mentioned article as well as a subsequent paper by the writer, "On the Osteology of the Iniomi" (Occas. Paper Bingham Oceanogr. Coll. no. 2, February 1929), is also strongly reflected in his discussion of the classification of these fishes. The perfect intergradations from normal eyes to telescopic, from an almost straight profile of the head to the rostral projection of *E. normalops*, Parr, and from a wide interorbital space to a very constricted one shown by the three forms *Evermannella normalops*, Parr, *E. atrata atlantica*, Parr, and *E. indica melanoderma*, Parr, as described and figured by the writer in 1928 (*loc. cit.* pp. 164–171), immediately proves the impossibility of making any sharp generic subdivision according to these features, as proposed by Roule with the introduction of his new genus *Coccorella* (Roule, *loc. cit.* p. 8 and p. 11).

Roule's suggestion that the genus *Dissomma*, Brauer, should be suppressed and its species included in the genus *Evermannella* has already previously been shown by the writer (1928, *loc. cit.* pp. 156–157 ; 1929, *loc. cit.* pp. 7 and 9–21) to be entirely contrary to the anatomical, as well as the external morphological, features of the forms compared. The statement that Schmidt has shown the genus *Dissomma* to lead gradually (ontogenetically) into the genus *Evermannella* is only a purely nomenclatural quasi-argument, Schmidt having merely found Roule's *Odontostomus* (=*Evermannella*) *permarmatus* to be identical with Brauer's *Dissomma anale*, but having in no manner attempted to show any closer relationship to exist between this form and any of the very different true representatives of the genus *Evermannella*.

Dissomma differs from *Evermannella* in being completely covered by fairly adherent scales, in the broad lamella-like expansion and overlapping of its maxillaries and præmaxillaries, in having its fused fronto-parietals covering only the anterior half of the brain-cavity proper (the postorbital portion of the cranium), in having the coracoids enormously expanded into wide plates without any distinctly marked off anterior process, in the much stronger development, higher insertions and more numerous rays of its pectoral fins, and in a great many other features of minor importance. *Evermannella*, on the other hand, is entirely naked, has absolutely no dentition on the tongue, has narrow, rod-like, and rather slender maxillaries and premaxillaries, has the fronto-parietals forming almost the entire dorsal roof of the brain-cavity proper, has only small coracoids of normal outline, with a well-marked anterior process, and its pectoral fins are small with few rays, inserted very low on the sides of the body. These differences are certainly far more significant than those on which Roule proposes to base the separation of a new genus, *Coccorella*, from the genus *Evermannella*.

In regard to *Dissomma*, the writer has further suggested that Brauer's generic designation is probably synonymous with *Scopelarchus*, Alcock, since the species described and figured by Alcock as *Scopelarchus guntheri*, so far as known, shows no generic and perhaps not even any specific differences from *Dissomma anale*, Brauer. On the basis of the above-discussed very great differences from the Evermannellidæ, a separate family Scopelarchidæ, with the type-genus *Scopelarchus*, Alcock (=*Dissomma*, Brauer), has been introduced (Parr, 1928, *loc. cit.* p. 156) and anatomically defined (Parr, 1929, *loc. cit.* p. 9). To this family have also been referred the genera *Scopelarchoides*, Parr, 1929, and *Benthalbella*, Zugmayer, and the genus *Promacheon*, Weber, has been tentatively included.

In his discussion of the classification of the genus *Omosudis*, Günther, Roule proposes to reunite the families Omosudidæ and Evermannellidæ, which were first separated from each other by Jordan. The present writer has already previously (1929, *loc. cit.*) shown, on ample anatomical grounds, that these two families are not only perfectly distinct, but apparently belong to entirely separate subdivisions of the order Iniomi. The Omosudidæ are characterized by extreme rudimentation of the suborbital bones and of the lateral ethmoidal processes, by a very strong reduction of maxillaries and præmaxillaries, and by the persistence of separate parietal bones, while the nasals are fused to the ethmoid—all features indicative of a very close relationship to the Sudidæ. The Evermannellidæ, on the other hand, show super-development of the suborbital bones, have well-developed lateral ethmoidal processes, maxillaries, and præmaxillaries, and have separate nasal bones, but the parietals fused to the frontals or entirely absent. The Evermannellidæ are thus most nearly related to the Scopelarchidæ, notwithstanding that they are also very sharply differentiated from the latter family, as already above discussed. Both families are probably, more remotely, related to the Aulopidæ and the Synodontidæ. The similarities between *Omosudis* and *Evermannella* pointed out by Roule are quite superficial and insignificant in comparison with the above-mentioned profound anatomical differences between the two genera (and families).

The impossibility of accepting Roule's suggestion that the genus *Benthalbella*, Zugmayer, should merely represent juvenile stages of the genus *Omosudis* will be obvious without further discussion when the following differences are pointed out. In *Benthalbella* the pectoral fins are very large, containing 22–26 strong rays inserted in typical Scopelarchid fashion on the sides of the body, the tongue has a series of teeth, but there is no dentition on the palatines. In *Omosudis* the pectoral fins are small and lowly inserted, with only about a dozen rays, the tongue has no teeth, but there is a series of large fangs in each palatine. In addition to these, there are also numerous other differences apparent from Zugmayer's illustration of *Benthalbella infans*, all indicative of relationship with the Scopelarchidæ, and not with the Omosudidæ.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

February 5th, 1930.—Prof. J. W. Gregory, LL.D., D.Sc., F.R.S., President, in the Chair.

The following communication was read:—

'Pre-Ordovician Rocks of the McDonnell Ranges (Central Australia).' By Sir Douglas Mawson, O.B.E., B.E., D.Sc., F.R.S., F.G.S., and Cecil Thomas Madigan, M.A., B.E., F.G.S. (Read by Dr. C. E. Tilley, B.Sc., F.G.S.)

This paper concerns the age and stratigraphical relations of a great series of quartzites, slates, and limestones forming the southern front of the McDonnell Ranges. These beds, dipping at a steep angle off the older Pre-Cambrian basement (Arunta Complex) of the Ranges, extend in an east-and-west direction with wonderful regularity for a length of at least 150 miles. The three principal quartzite-members of the group weather out in great wall-like masses, separated by intervening valleys carved out of the calcareous and shaly sediments, and their outcrops south of Alice Springs have been correlated with the well-known fossiliferous Ordovician rocks of the Horn Valley at the Finke River Gorge.

The Authors now provide evidence to show that this great series of rocks lies stratigraphically between the undoubted Ordovician rocks (Larapintine formation) and the Arunta Pre-Cambrian Complex.

The stratigraphical succession is as follows:—

(3) Pacoota Quartzite (Larapintine).
(2 *b*) Pataoorrta Series—quartzite, shales, limestones (2850 feet).
(2 *a*) Pataknurra Series—quartzites, slates, limestones (7500 feet):
(1) Arunta Complex (Pre-Cambrian).

They form a Pre-Ordovician series, upon which rests unconformably the Larapintine Formation with its basal members formed of conglomerates and breccias. Horizons rich in Cryptozoa and *Girvanella*-like algal growths characterize the series. The Cryptozoa of the lower series are identical with those occurring in beds associated with the Sturtian tillite in the Flinders Ranges of South Australia, and the rocks are tentatively referred to the late Pre-Cambrian. The Upper Pataoorrta Series, referred to the Cambrian, is characterized by dendritic varieties of Cryptozoa and *Girvanella*-like algal growths which closely resemble those occurring in the Cambrian rocks of South Australia.

March 26th, 1930.—Prof. E. J. Garwood, M.A., D.Sc., F.R.S., President, in the Chair.

The following communication was read:—

'*Ambocœlia* Hall and certain similar British Spiriferidæ.' By Thomas Neville George, M.Sc., Ph.D., F.G.S.

The paper deals with several small Spirifers of the Upper Palæozoic rocks of Britain, which have usually been referred to the genus *Ambocœlia*. The structure of the latter is briefly described, and it is shown that the British forms do not exhibit the features emphasized by Hall in his description of *Ambocœlia*; in particular, they differ in the surface-ornament, in the cardinal process, and in the musculature of the dorsal valve. Two new genera, distinguished one from the other by details of ornament and cardinal area, are therefore established for their reception. A detailed discussion of the morphology of these forms is given.

In a general classification of the Spiriferidæ, it has been customary in the past to unite these *Ambocœlia*-like species with either the Martiniinæ, Waagen or the Reticulariinæ, Waagen. In external form, *Ambocœlia* and the new genera are markedly distinguished from both these subfamilies in the development of shell-shape: while in the latter group this is normally a change from an unmodified bi-convex rectimarginate to an everse alternate uniplicate stage, in the former group it is the opposite of this in the dorsal valve, for the neanic convex condition becomes planate or concave with growth, which, in conjunction with a more or less developed dorsal sulcus, leads to an inverse opposed stage. The species described in this paper also differ obviously in external ornament from the costate Martiniinæ, and less obviously, but none the less really, from the geminospinous forms usually referred to *Reticularia*. Internally, differences between the groups are equally marked in the characters of internal septa, cardinal process, and dorsal musculature. It is, therefore, proposed to create a new subfamily for the reception of *Ambocœlia* and the new genera.

The later portion of the paper consists of a detailed description of the British species from the Devonian, Carboniferous, and Permian Systems. Some of these are new.

Prof. J. W. Gregory, LL.D., D.Sc., F.R.S., V.P.G.S., exhibited a sample and slides of the dust which fell in 'red rain' in New Zealand between October 6th and 10th, 1928; the dust had been recently described in correspondence in 'Nature,' March 15th, 1930, by Dr. E. Kidson and himself. The 'red rain' of Victoria and New Zealand of 1903 had been shown from its diatoms by Chapman & Grayson to have been derived from the salt-lakes of the interior of Australia. The recent occurrence in New Zealand was of special interest from the large quantity that fell, which is estimated by Dr. Kidson as over 200,000 tons. The diatom exhibited under the microscope resembled *Stauroneis*, and others were like *Pinnularia*—resembling those of the New Zealand rain of 1903 described by Chapman & Grayson.[1]

April 30th, 1930.—R. S. Herries, M.A.,
Vice-President, in the Chair.

The following communications were read:—

1. 'Some Non-Marine Lamellibranchs from the Upper Part of the Coal Measures.' By Emily Dix, M.Sc., F.G.S., and Arthur Elijah Trueman, D.Sc., F.G.S.

This paper deals with the non-marine shells which occur in the upper part of the Coal Measures, namely, in the higher part of the *Pulchra* Zone and in the *Phillipsi* and *Tenuis* Zones. Recent studies of Carboniferous non-marine shells have been chiefly concerned with the Lamellibranchs which occur below these horizons. Nearly all the shells found in these higher measures are members of the genus *Anthracomya*, and most of them are related to the group of *A. phillipsi*; but there is evidence that another group, represented by shells which resemble *A. lanceolata* Hind,[1] occurs more rarely at widely separated horizons.

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[1] 'Victorian Naturalist' vol. xx (1903) p. 29.

The holotype of *Anthracomya phillipsi* (now in the Manchester Museum) is figured and redescribed, and the variations of this species which occur at different horizons in the *Phillipsi* and *Tenuis* Zones are discussed. The small shells from the base of the Newcastle-under-Lyme Group of North Staffordshire, described by Wheelton Hind as *A. calcifera*, have been re-examined; it is shown that they are associated with larger crushed shells (of the group of *A. phillipsi*), and it is suggested that *A. calcifera* represents a dwarfed form of this group, in which the adult characters are attained at a small size. The shells are distinct from those which occur in the Assise de Rive-de-Gier and which have been referred to *A. calcifera* by Prof. P. Pruvost.

It is shown that a distinctive series of *Anthracomya*, including *A. adamsi* Hind *non* Salter, *A. dolabrata* Hind, and several new forms, occurs near the middle of the *Pulchra* Zone in South Wales, North Staffordshire, and Yorkshire; in each area the horizon overlies a well-marked marine bed (the Gin Mine of North Staffordshire and the Mansfield Bed of Yorkshire).

Another characteristic horizon is found near the top of the *Pulchra* Zone, the shells consisting almost entirely of small forms regarded as related to *Naiadites elongata* Hind. The distinction of these and other small forms from small examples of *Anthracomya phillipsi*, especially in crushed specimens, is dealt with, in relation to the range of *A. phillipsi* and its allies.

The variants of *A. phillipsi* characteristic of the *Phillipsi* Zone can be recognized in almost every British coalfield. Where it is present, the succeeding *Tenuis* Zone can also be readily distinguished. Although several horizons within these zones appear to be characterized by distinctive forms, the Authors are unable to suggest any further subdivision of the zones.

It is shown that, in several respects, the sequences determined in many British coalfields are remarkably similar, and reasons are advanced for the view that at certain periods in the late Carboniferous Period there was considerable uniformity in the conditions over large parts of Britain. It is also indicated that there are great similarities in the sequence in the upper part of the Westphalian of the Continent.

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[1] See E. Dix & A. E. Trueman, Geol. Mag. 1929, p. 500, fig. 1 c.

2. 'The Flora of the Upper Portion of the Coal Measures of North Staffordshire.' By Emily Dix, M.Sc., F.G.S.

The paper deals with the distribution of fossil plants in the Upper Coal Measures, and in the upper part of the Middle Coal Measures of North Staffordshire above the horizon of the Ash Coal.

Various views have been put forward concerning the classification of these measures, but the classification which is generally used was suggested by Dr. Walcot Gibson in 1901, who placed the base of the Upper Coal Measures at the Bassey Mine Ironstone. He further divided the Upper Coal Measures into the Black Band Group, the Etruria Marl Group, the Newcastle-under-Lyme Group, and the Keele Group. Kidston in 1905 suggested that the Keele Group represented the true Upper Coal Measures, which he called the 'Radstockian Series'; the remaining three groups he placed in the Transition Coal Measure or Staffordians Series.

The late Dr. Wheelton Hind in 1905 criticized the introduction of these new terms, and said that there was no good reason for taking the Bassey Mine Ironstone as the base of a subdivision, because a similar fauna and flora occurred both above and below that horizon.

Few plants have hitherto been recorded from the measures for some distance below the Bassey Mine Ironstone, and the chief purpose of this paper is to give an account of these measures with the view of determining the horizon which marks the entrance of the Staffordian flora in North Staffordshire.

A considerable number of new records are given, and from these records it is clear that the measures for some hundreds of feet below the Bassey Mine Ironstone yield a flora in which Radstockian and Yorkian species are mingled, and therefore it is concluded that the base of the Staffordian should be drawn below the Chalky Mine Ironstone, about 400 feet below the Bassey Mine Ironstone.

This conclusion is of importance in the correlation of such areas as South Wales, Staffordshire, and Somerset by means of fossil plants. In South Wales it has been shown that the base of the Staffordian can be drawn at the horizon of the No. 3 Rhondda Seam, which is near the base of the *Phillipsi* Zone. The base of the *Phillipsi* Zone in Staffordshire has been placed at the Lady Coal, and it had thus appeared that the base of the *Phillipsi* Zone and the base of the Staffordian are not in such close proximity as in South Wales. The conclusions reached in this paper, however, establish the similarity in the succession at these horizons in the two areas.

1.

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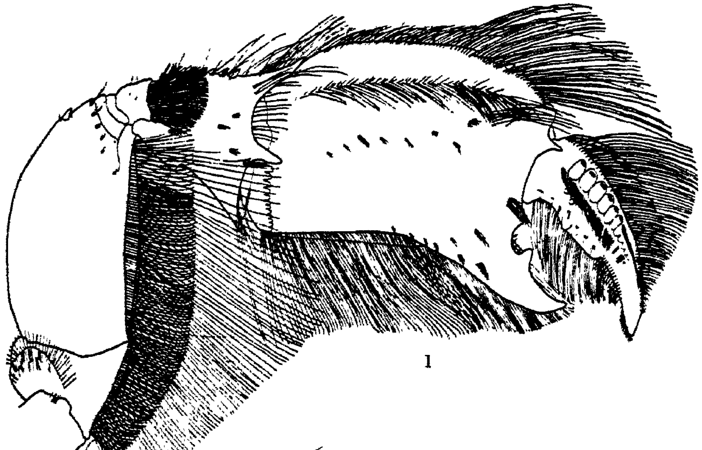
UPOGEBIA PUGETTENSIS.



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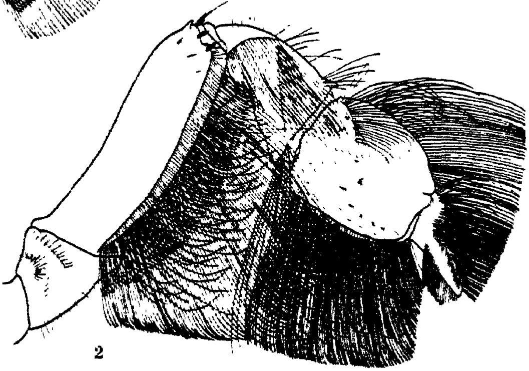

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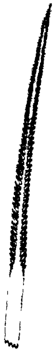

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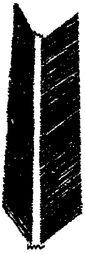

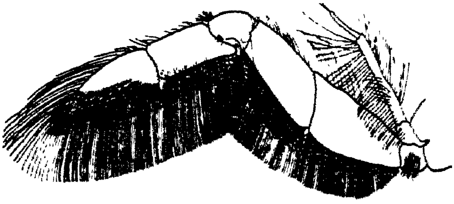

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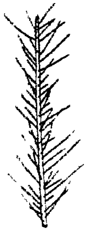

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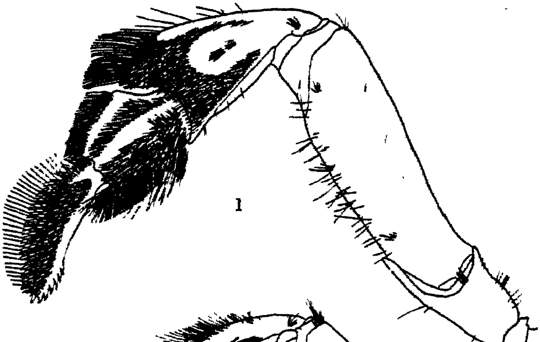

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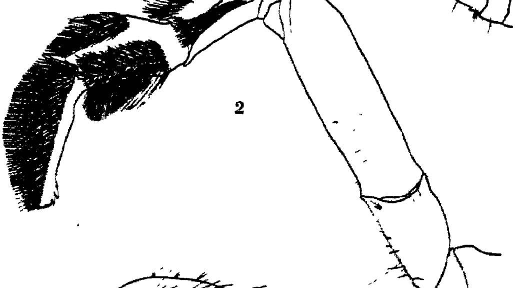

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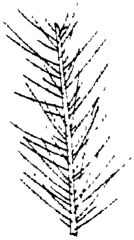

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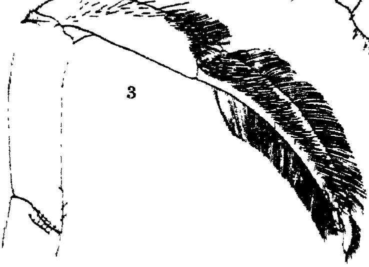

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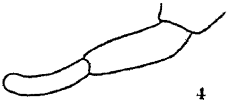

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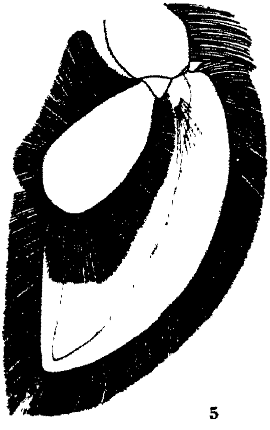

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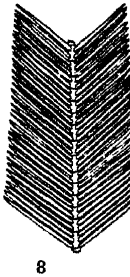

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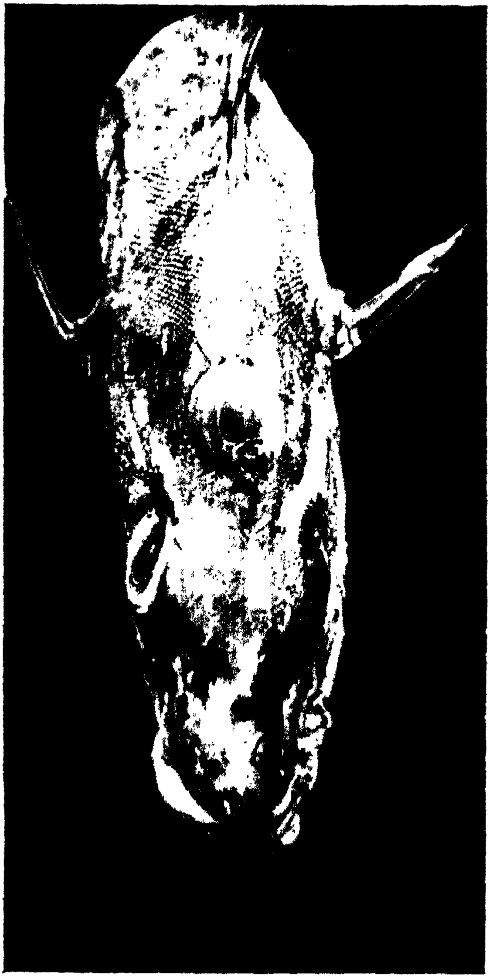
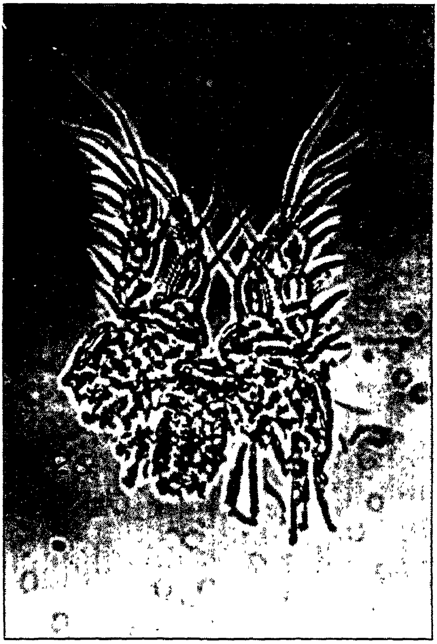


Dorsal view of the Head of the Three-eyed Haddock.

(Copyrighted photograph reproduced by courtesy of WIDE WORLD PHOTOS.)



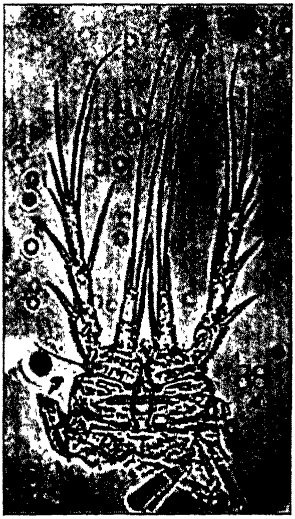


Fig. 25.—Nitocra lacustris (Schmankevitsch). First pair of feet of female.
Fig. 38.—Diagoniceps lævis, sp. n. Third pair of feet of female.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 32. AUGUST 1930.

XVIII.—*New Rhodesian Lepidoptera Heterocera.* By W. H. T. Tams.

(Published by permission of the Trustees of the British Museum.)

[Plates VI.-VIII.]

The moths described in this paper form part of a large collection of Lepidoptera made by the late Hereward C. Dollman in N.W. Rhodesia during the years 1913–1918, and subsequently presented to the British Museum by his father. Most of the specimens were in fine condition, as many of them were bred, and accompanying the collection was a volume of exquisite drawings of the larvæ. In view of the fact that it has been decided to publish these figures, it has been found necessary to describe the following new species, so that their names may be available for the forthcoming publication.

Lymantriidæ.

Porthesia apatela, sp. n. (Pl. VII. figs. 5, 6.)

♂. Palpus cartridge buff, middle of 2nd segment tinged with orange buff outwardly. Antenna with shaft cartridge buff, pectinations honey yellow. Head and thorax cartridge buff. Tergum with proximal half cartridge buff, distal half orange buff to ochraceous buff. Pectus cartridge buff, orange buff in front. Venter cartridge buff. Legs cartridge buff, fore coxæ banded proximally with orange buff. Fore and hind wings cartridge buff above and beneath; proximal four-fifths of fore wing costa broadly infuscate beneath. Expanse 22 mm.

♀. Entirely cartridge buff, except for anal tuft, which is bone brown with a surrounding fringe of orange buff. Expanse 39 mm.

Holotype ♂, allotype ♀, and 5 paratype ♀♀: N.W. Rhodesia, without further data.

Dasychira ænotata, sp. n. (Pl. VII. fig. 8, 9.)

♂. Palpus bistre, edged below with light to warm buff. Antenna bistre, the shaft with some scattered vinaceous buff scales. Head bistre with some warm buff intermixed. Thorax bistre, the scales tipped with vinaceous buff. Tergum light to warm buff heavily shaded with bistre. Pectus and venter light to warm buff. Legs light to warm buff shaded with bistre. Fore wing bistre, inclined to sepia along costa, where there are small light buff patches at the commencement of the various fasciæ; some cinnamon buff through the cell; a patch of cinnamon buff irrorated with bistre below the cell antemedially, extending along the anal vein to just beyond the postmedial fascia; antemedial fascia velvety clove brown, bowed (concavity basad), crenulate; a fairly large reniform stigma, finely outlined proximally, more broadly distally, with velvety clove brown, filled in with cinnamon buff; a crenulate S-waved postmedial fascia, concave basad between costa and vein *Cu* 1, convex basad between *Cu* 1 and inner margin, velvety clove brown finely edged with cinnamon buff distally; subterminal fascia similar, but more broadly velvety clove brown, especially between vein *Cu* 2 and anal vein, where the light distal edging is warm buff and prominent; a preterminal series of fine velvety clove brown interneural dashes; fringe with a light to warm buff line at base and another through middle, interrupted at vein-ends. Hind wing fuscous, a little darker at the termen, with a light buff line through base of fringe. Underside of fore wing fuscous, with a patch of light buff at end of cell, light buff along inner margin and some fine light buff irroration accentuating the postmedial fascia; hind wing light buff, with fuscous irroration, a fuscous spot at end of cell, and fuscous postmedial and subterminal fasciæ, curved (concavity terminad) to vein *M* 1 and just below vein *M* 1 respectively, thence straight to inner margin near anal angle. Expanse 30 mm.

♀. Lighter, markings less distinct; fore wing cinnamon, sparsely irrorated and shaded with bistre and velvety clove brown. Underside similar to that of ♂, but lacking patch of light buff at end of cell; markings less distinct. Expanse 35–36 mm.

Holotype ♂ : Mwengwa, Kafue River, 17. viii. 1913.

Allotype ♀ : Mwengwa, 11. viii. 1913.

Paratypes : Mwengwa, Kafue River, 4 ♂ ♂ 12, 14, 14, 17. viii. 1913, 2 ♀ ♀ 8, 14. viii. 1913 ; Mwengwa, 1 ♂ 20. viii. 1913, 2 ♀ ♀ 10, 20. viii. 1913 ; Solwezi, 3 ♂ ♂ 7. i. 1918, 29. iii. 1918, iv. 1918.

Notodontidæ.

Polelassothys callista, sp. n. (Pl. VII. fig. 7.)

♂. Palpus chestnut. Antenna chestnut and ochraceous orange at base, shaft white irrorated with warm sepia. Head chestnut. Thorax: patagium velvety bone brown mixed with chestnut; tegula white tinged with grenadine pink, with a fine transvese medial line of light mouse grey; thoracic crests velvety bone brown and chestnut brown mixed. Tergum cartridge buff shaded with bone brown and fuscous, with a prominent basal crest of velvety bone brown and chestnut brown. Pectus and venter cartridge buff. Legs cartridge buff; fore leg with tibia strongly shaded and banded with bone brown and chestnut brown, tarsus banded with bone brown proximally, chestnut to chestnut brown distally; other legs without the tibial shading. Fore wing white to cartridge buff, tinged (except along costa) with grenadine pink; a small velvety bone brown spot at middle of wing-base; three fasciæ picked out in silvery grey, the grey formed by finely black-tipped whitish scales; the first fascia subbasal, crenate, deeply bowed (concavities basad), from costa at one-fifth to inner margin at one-fifth; then a crenulate, trilineate antemedial fascia of two silvery grey lines separated by ground colour, accentuated basad (except just below cell) by some silvery grey shading irrorated or edged distad with velvety bone brown; a fine velvety bone brown streak along the discocellulars; a waved, crenulate, trilineate postmedial fascia of two silvery grey lines separated by ground colour; an irregularly dentate (points terminad) velvety bone brown subterminal fascia, the two largest dentations on veins *M* 2 and *M* 3; between the subterminal fascia and termen a patch of fuscous shading from apex to vein *M* 1, a broad band of ground colour along vein *M* 2, a V-shaped shade (point terminad) of velvety bone brown enclosing dentation on vein *M* 3, with chestnut brown shading below it but not reaching tornus; a prominent series of interneural terminal velvety bone brown dashes, grading into silvery grey towards tornus; fringe chestnut brown, with a silvery grey line along its base, chequered with chestnut at vein-ends, distally with fuscous. Hind wing white tinged with cartridge buff, with a few fine inconspicuous fuscous scales at vein-ends. Underside of fore wing white tinged with cartridge buff, broadly fuscous black to fuscous from costa to lower margin of cell and vein *Cu* 2, except for a white strip from end of cell, between veins *M* 1 and *M* 3, to termen, and some narrow white edging on costa before apex; terminal series of dashes fuscous to fuscous black interrupted with white at vein-ends, the fringe fuscous chequered with chestnut brown; hind wing underside similar to upperside, with termen finely edged with fuscous between veins *Sc* and *M* 2.

Expanse 30 mm.

♀. Similar to ♂, but with hind wing lightly suffused with fuscous over distal half, with a terminal series of interneural fuscous dashes.

Expanse 30 mm.

Holotype ♂ and allotype ♀: Solwezi, ♂ 26. i. 1918, ♀ 30. i. 1918.

Paratypes: ♂ and ♀, Solwezi, 30. i. 1918.

Chadisra beltista, sp. n. (Pl. VIII. figs. 4, 9.)

♂. Palpus blackish brown dorsally, white streaked with fuscous ventrally. Antenna with shaft white tinged with lichen green, sparsely irrorated with fuscous, pectinations bone brown dorsally, honey yellow ventrally. Head with vertex fuscous to blackish brown, with white irroration at base of antenna, the frons sepia irrorated with white. Thorax with patagium warm sepia streaked with white, tegula and rest of thorax lichen green with traces of sepia irroration, mesothoracic crest tipped on each side with warm sepia. Tergum warm buff tinged dorsally with warm sepia, with a warm sepia crest at base. Pectus white tinged with warm sepia, with two blackish brown stripes in front. Venter light buff irrorated with warm sepia. Legs white mixed with warm sepia, the fore tibia tinged with lichen green, all tarsi ringed with blackish brown. Fore wing white irrorated with fuscous, densely in proximal third, less densely in distal third, sparsely in medial third, with a lichen green tinge over proximal third, along costa and anal vein, and between postmedial and subterminal fasciæ; an irregular and indistinct subbasal fascia; a trilineate, crenate, bowed (concavity basad) antemedial fascia of two fuscous black lines (the distal more prominent) separated by lichen green; a fuscous black streak on discocellulars; a trilineate, dentate postmedial fascia, bowed (concavity basad) from costa to vein *Cu* 1, continuing obliquely to inner margin beyond middle, its proximal line prominent and fuscous, its distal indistinct, fuscous and separated from the proximal line by a line of cartridge buff; an irregularly dentate, trilineate subterminal fascia (the two fuscous black lines very indistinct, the lichen green separating them very prominent), commencing with a velvety fuscous black dash on costa and a prominent velvety fuscous black sagittate mark (point basad) in the fork between *R* 4 and *R* 5; termen fuscous black interrupted at vein-ends; fringe fuscous, chequered fuscous black at vein-ends. Hind wing white tinged with cartridge buff along inner margin, lightly shaded with fuscous irroration along costa above cell and vein *Rs* to apex; termen lightly edged with fuscous, with fuscous streaks in fringe at vein-ends; the characteristic patch at anal angle fuscous black with a lichen green crenulate line through it. Underside white, fore wing with fuscous irroration along costa, with a dash of fuscous black followed by a prominent white spot postmedially and further white interrupting dashes to apex; veins irrorated with fuscous black; termen fuscous interrupted with white at vein-ends; fringe white edged with fuscous, chequered with fuscous black at vein-ends; hind wing as on upper side, patch at anal angle almost restricted to fringe. Expanse 43–46 mm.

♀. Similar, often with a tinge of vinaceous in the fore wing; with underside of fore wing, fringe and anterior third of hind wing above and beneath, strongly suffused with fuscous. Expanse 50–60 mm.

Holotype ♂ and allotype ♀: Solwezi, xi. 1917.

Paratypes: Mwengwa, 2 ♂ ♂ 3, 4. iii. 1914, 1 ♀ 9. iii. 1914; Solwezi, 2 ♂ ♂, 3 ♀ ♀ xi. 1917.

Chadisra callitoxa, sp. n. (Pl. VIII. figs. 5, 10.)

♂. Palpus warm sepia irrorated with light to warm buff. Antenna with shaft light buff banded with warm sepia, the pectinations honey yellow. Head warm buff mixed with warm sepia to bone brown. Thorax bone brown mixed with light buff, with which the patagium, the tegula, and the thoracic crests are edged. Tergum light to warm buff suffused with warm sepia. Pectus light to warm buff, bone brown in front. Venter light to warm buff. Legs light buff shaded with warm sepia, with which the fore tibia is narrowly banded; tarsi rich warm sepia, each segment tipped with light buff. Fore wing light buff, densely irrorated and shaded with warm sepia and bone brown; from wing-base to antemedial fascia heavily streaked longitudinally with bone brown and velvety bone brown, except along inner margin; a trilineate, evenly bowed (concavity basad) antemedial fascia, consisting of two velvety bone brown lines separated by ground colour; a streak of velvety bone brown along discocellulars; an indistinct, waved, trilineate postmedial fascia from just beyond middle of costa to inner margin at two-thirds; subterminal fascia represented by a few short, longitudinal, interneural, velvety bone brown streaks from costa to vein *M* 3, preceded by a bone brown shade along costa from postmedial fascia; the most prominent mark on the fore wing consists of a strong velvety bone brown arc (concavity tornad) from termen at vein *M* 3 to inner margin at three-fourths; termen edged with bone brown and velvety bone brown, interrupted interneurally; fringe shaded with bone brown, more heavily at vein-ends. Hind wing cartridge buff tinged with light buff at inner margin and fringe, lightly shaded with bone brown along costa; vein-ends and termen finely bone brown; characteristic mark at anal angle bone brown to velvety bone brown, crossed by two streaks of ground colour. Underside cartridge buff, the fore wing lightly suffused with bone brown except below the cell, with some dark and light marks on the costa distally; the hind wing under side similar to upper side, the marking at anal angle less prominent. Expanse 40 mm.

♀. Similar, but with fore wing and distal two-thirds of hind wing above and beneath suffused with bone brown. Expanse 42 mm.

Holotype ♂ and allotype ♀: Solwezi, ♂ 26. xi. 1917, ♀ xi. 1917.

Paratypes: Solwezi, 2 ♂ ♂ 5. ii. 1918, 10. iv. 1918, 3 ♀ ♀ iv. 1917, 5. ii. 1918, 27. iii. 1918.

N.W. Rhodesia (without further data), 1 ♂, 2 ♀ ♀.

Closely related to *C. grisea*, Gaede.

Stauropus æschyntela, sp. n. (Pl. VIII. figs. 3, 8.)

♂. Palpus cartridge buff, strongly shaded with fuscous to bone brown outwardly. Antenna with the shaft *whitish* irrorated with fuscous to bone brown, pectinations cinnamon.

Head, thorax, tergum, and legs *whitish* mixed with fuscous to bone brown, the tergum rather heavily shaded. Pectus cartridge buff, venter cream buff. Fore wing *whitish* densely irrorated with bone brown; a short longitudinal bone brown streak at wing-base, parallel with costa; antemedial fascia indistinct except at costa, where it commences as a distinct bone brown dash sharply oblique from costa at one-fourth, terminad, to upper margin of cell, thence waved and oblique to middle of inner margin; a bone brown streak along the discocellulars with some shading above it at middle of costa; a slightly bowed postmedial fascia almost indistinguishable except for a prominent dash of bone brown on costa at two-thirds; a subterminal fascia of bone brown spots, set somewhat irregularly; termen finely bone brown with dots interneurally. Hind wing *whitish* lightly suffused with fuscous, the veins and termen prominent. Underside *whitish*, immaculate except for a strong fuscous fascia along proximal two-thirds of costa. Expanse 40 mm.

♀. Slightly brown in tone. Fore wing with three oblique dashes from veins *M* 3, *Cu* 1, and *Cu* 2 subterminally, to the interneural terminal dots below them. Under side of fore wing suffused with fuscous, fringe whitish. Expanse 47 mm.

Holotype ♂ : Solwezi, 3. iv. 1918.

Allotype ♀ : Kashitu, 7. viii. 1915.

Paratypes : Kashitu, ♂ 2. iv. 1915, ♀ 17. iv. 1915 ; Solwezi, ♂ 6. iv. 1918.

Sphingidæ.

Acanthosphinx güssfeldti eothina, subsp. n. (Text-figs. 3, 4).

Generally smaller than the western subspecies (text-figs. 1, 2).

♂ genitalia: Uncus not cleft or much less deeply cleft terminally; valve with processes of harpe more slender.

Holotype ♂ : Solwezi, 28. vi. 1917.

Allotype ♀ : Solwezi, 12. x. 1917.

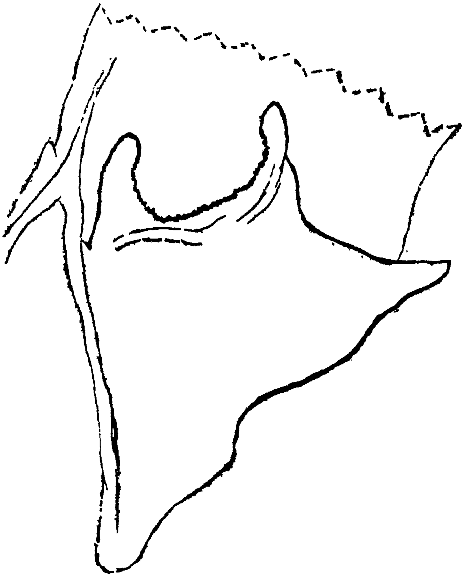
Paratype ♂ : Solwezi, 23. x. 1917.

Saturniidæ.

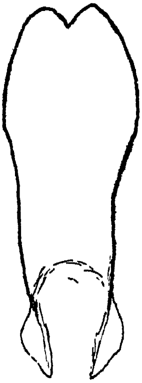
Pseudaphelia dialitha, sp. n. (Pl. VII. fig. 3.)

♂ and ♀. Palpus light orange yellow, heavily infuscate dorsally. Antenna black. Head and thorax light orange yellow, the latter paling to straw yellow posteriorly. Tergum straw yellow, each segment edged distally with light orange

Text-fig. 1.

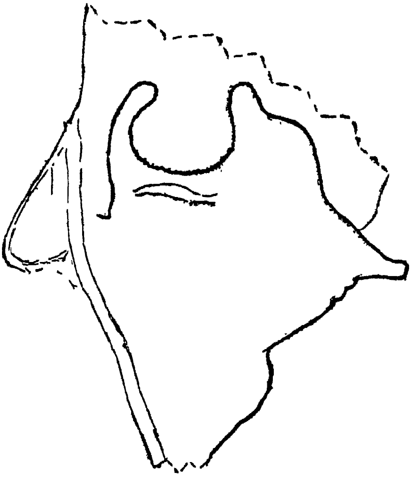


Text-fig. 2.

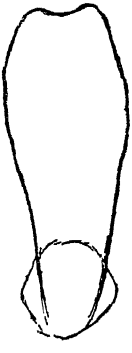


Acanthosphinx güssfeldti güssfeldti, Dew.
Fig. 1.—Valve, proximal half, showing harpe.
Fig. 2.—Uncus.

Text-fig. 3.



Text-fig. 4.



Acanthosphinx güssfeldti eothina, subsp. n.
Fig. 3.—Valve, proximal half, showing harpe.
Fig. 4.—Uncus.

yellow. Pectus straw yellow. Venter straw yellow, each segment edged distally with light orange yellow and bearing medio-dorsally a round black spot (diameter 1 mm.). Legs straw yellow tinged with light orange yellow, the tibiæ and tarsi heavily infuscate dorsally. Fore wing straw yellow, costa narrowly infuscate along proximal two-thirds, wing-apex broadly infuscate, the termen moderately infuscate ; proximal edge of fuscous shade oblique from costa at two-thirds to just above vein *M* 2 at about three-fourths (sometimes even more extensive) ; a fine fuscous subterminal fascia, crenate (concavities terminad, points on veins), roughly parallel with termen ; inner edge of terminal fuscous shade crenate (concavities basad, points on veins) ; six terminal light orange yellow spots on veins *R* 5 to *Cu* 2 ; three fuscous-ringed light orange yellow spots at end of cell, outside, the first between veins *R* 5 and *M* 1, the second small, between veins *M* 1 and *M* 2, and the third and largest between *M* 2 and *M* 3 ; of these the middle spot is often, the upper sometimes, wanting ; fringe fuscous. Hind wing straw yellow with a terminal fuscous margin, about 1·5 mm. wide except at points on veins (2·5 mm.) ; seven light orange yellow terminal spots on veins *Rs* to *A* 2; fringe fuscous. Underside similar, but hind wing with a fuscous-ringed light orange spot at angle between vein *M* 2 and discocellulars.

Expanse, ♂ 70 mm., ♀ 80 mm.

Holotype ♂ and allotype ♀ : Mwengwa, xi. 1914.

Paratypes : 1 ♂, 4 ♀ ♀, Mwengwa, 26. i. 1914 (2), 26. ii. 1914, 1. iii. 1914, xi. 1914.

Gynanisa maia daula, subsp. n. (Pl. VI.)

Similar to *G. maia maia*, but with the fore wing apex distinctly produced, the termen being noticeably bowed. The part of the antemedial fascia within the cell is more acutely produced apicad, and the postmedial and subterminal fasciæ are more deeply bowed between vein *Cu* 1 and inner margin. This subspecies seems very variable in size.

Expanse 130–170 mm.

Holotype ♂ : N.W. Rhodesia (without further data).

Allotype ♀ : Solwezi, 14. x. 1917.

Paratypes : ♂ Solwezi, ix. 1918 (166 mm.) ; ♂ Mwengwa, 7. xi. 1914 (150 mm.) ; ♂ Mwengwa, x. 1914 (126 mm.) ; ♂ Mwengwa, x. 1914 (128 mm.); ♂ Mwengwa, xi. 1914 (134 mm.); 3 ♀ ♀, N.W. Rhodesia, without further particulars. These three measure 128, 132, and 160 mm.

Lasiocampidæ.

Genus Eucræra, nom. nov.

Eucræra, nom. nov. for *Ceratopacha* Auriv., Arkiv för Zoologi, Band 5, no. 5, p. 13 (1909), nec Stephens, Ill. Brit. Ent. (Haust. iv.) p. 389 (Jan. 1835), *Cerotopacha*, corrected to *Ceratopacha* in Index to the same volume, p. 426 (Feb. 1835).

Chrysopsyche pyriphlecta, sp. n. (Pl. VII. figs. 1, 2.)

♂. Palpus warm buff, fuscous dorsally. Antennal shaft buffy olive to deep olive irrorated with olive buff. Head and thorax ochraceous orange, the latter with buffy olive to deep olive intermixed posteriorly. Tergum buffy olive to deep olive, with an ochraceous terminal tuft. Pectus warm buff in front, to deep olive behind. Venter buffy olive to deep olive. Fore wing buffy olive to deep olive; costa narrowly scarlet to three-fourths; a narrow longitudinal scarlet fascia through the cell to just beyond the postmedial fascia, intensified at discocellulars; a similar fascia from base to tornus between vein *Cu* 2 and anal vein; a fine fuscous black antemedial fascia from just below costa at about one-third, bowed between costa and base of vein *Cu* 1, and again between base of *Cu* 1 and inner margin (concavities basad); a fuscous black postmedial fascia, slightly oblique, not quite straight, from just beyond middle of costa (below which it commences) to just beyond middle of inner margin; subdued scarlet suffusion between the bases of all the veins round the cell, and similarly between the ends of the veins before the termen, leaving a narrow, irregularly wavy fascia representing the subterminal; fringe buffy olive to deep olive. Hind wing buffy olive to deep olive, richer in tone above the cell; an indistinct obsolescent postmedial fascia at right angles to longitudinal axis of cell; a broad shade of raw sienna between veins *Rs* and *A* 2, reaching from postmedial fascia to termen; fringe edged with olive buff. Underside similar; fore wing fasciæ less prominent, postmedial of hind wing more prominent; scarlet on fore wing replaced by orange chrome, and more or less reduced in extent; in oblique light a spectrum violet sheen is visible over the deep olive parts.

Expanse 50 mm.

♀. Antennal shaft warm buff irrorated with cadmium yellow, pectinations cinnamon, those on distal half of antenna tipped with bone brown. Palpus, head, thorax (dorsum and pectus), abdomen (tergum and venter), and legs cadmium yellow inclined to orange. Fore wing mustard yellow, with sparse fuscous to fuscous black irroration widely and diffusely distributed along the veins as far as the subterminal fascia, which is similarly irrorated; a deeply and unevenly bowed (concavity basad) antemedial fascia of English red ; an orange spot on discocellulars ; postmedial fascia outcurved (concavity apicad) to near junction of veins *R* 4 and *R* 5, there angled and running obliquely to inner margin at two-thirds, straight between veins *R* 5 and *M* 1, slightly bowed (concavity terminad) between vein *M* 1 and anal vein (festooned between the veins), thence inwardly oblique to inner margin; subterminal fascia slightly sinuous, consisting of a series of six orange deep lunules (convexity basad) between veins *R* 4 and *Cu* 2 interneurally, irrorated with fuscous to fuscous black ; a fine orange longitudinal streak from postmedial fascia to tornus between vein *Cu* 2 and anal vein ; fringe apricot yellow. Hind wing cadmium yellow inclined to orange, fringe edged with apricot yellow. Underside cadmium yellow to orange ; fore wing with traces of fasciæ seen through the wing, and some mustard yellow at apex with the termen finely edged with olive buff and the fringe apricot yellow ; hind wing cadmium yellow to orange, with mustard yellow along costa to apex, and traces of an orange rufous postmedial fascia deeply bowed (concavity basad) between middle of costa and vein *Rs*, thence passing through the junction of vein *Cu* 1 with cell, and obsolescent ; termen and fringe as in fore wing.

Expanse 52–78 mm.

Holotype ♂ and allotype ♀ : Solwezi, 4. i. 1918.

Paratype ♀ : Solwezi, 16. i. 1918.

Craspia hypolispa, sp. n. (Pl. VIII. figs. 1, 2.)

♂. Palpus warm buff streaked with chestnut brown. Antennal shaft chestnut brown irrorated with warm buff, pectinations bone brown. Head and thorax chestnut mixed with chestnut brown and warm buff. Tergum chestnut brown. Pectus warm buff. Venter warm buff irrorated with vinaceous brown. Legs light to warm buff streaked and irrorated with vinaceous brown. Fore wing chestnut brown, sometimes with traces of warm buff irrorated with vinaceous brown from discocellulars almost to termen, below the cell in proximal half, and also before the tornus; veins chestnut ; a small tuft of hair-scales at wing-base, velvety bone brown proximally, cartridge buff distally ; a velvety bone brown antemedial fascia slightly oblique from costa at one-third to inner margin at one-third, slightly bowed between costa and cubito-anal fold, and again between the latter and the inner margin, where there is a prominent tuft of glossy bone brown scales; a velvety bone brown lunule on discocellulars; postmedial fascia velvety bone brown, commencing on costa near antemedial, oblique to a point distad of junction of vein *R* 4 with stalk of *R* 5–*M* 1, parallel with discocellulars to vein *M* 2, bowed (concavity terminad) between *M* 2 and anal vein, then oblique inwardly to middle of inner margin; subterminal fascia merely indicated by a preceding bone brown shade, the distal edge of which is bowed (concavity basad) from costa to vein *M* 2, thence curving out towards the termen and forming a broad projection between veins *M* 2 and *Cu* 1, after which it runs from middle of vein *Cu* 1 to inner margin; some white irroration, and velvety bone brown dots before termen; fringe chestnut brown, edged interneurally with light buff. Hind wing chestnut brown, veins chestnut; some long warm buff to drab hair on proximal half; postmedial fascia velvety bone brown, straight, obsolescent towards inner margin near anal angle; subterminal fascia similar to that on fore wing; cartridge buff irroration at apex. Under side of fore wing fuscous to the indistinct postmedial fascia, then an extensive patch of warm buff reaching to the subterminal region, with an extension basad between veins *M* 1 and *M* 2 to the discocellular lunule and pointed extensions terminad along veins *M* 2 to *A* 2; costa chestnut brown irrorated with warm buff; from buff patch to termen chestnut brown; fringe as on upper side; under side of hind wing chestnut brown densely irrorated with warm buff, with, at the middle, a varying patch of warm buff irrorated with vinaceous brown; postmedial fascia more prominent than on upper side.

Expanse 40–44 mm.

♀. Similar, richer in colour, with sparse white irroration; fore wing broader, hind wing termen more rounded; termen in both fore and hind wings crenulate; underside fore wing warm buff over proximal two-thirds, diffusely edged with vinaceous brown; distal one-third densely irrorated with chestnut brown; long, fine, drab and chestnut brown hair-scales over proximal half; underside hind wing densely irrorated with chestnut brown and vinaceous brown; wavy postmedial fascia very prominent, chestnut brown.

Expanse 54–56 mm.

Holotype ♂: Mwengwa, 20. iv. 1914.

Allotype ♀ : Solwezi, iii. 1918.

Paratypes : ♀, Mwengwa, 22. iv. 1914 ; ♀, Solwezi, 15. ii. 1918.

Odontocheilopteryx dollmani, sp. n. (Pl. VIII. figs. 6, 7.)

♂. Palpus cream colour, lightly decorated with Indian red. Antennal shaft cream colour, streaked with Indian red at base, pectinations honey yellow. Head cream colour, the frons laterally finely streaked with Indian red. Thorax cream colour, tegula edged with a few Indian red scales. Tergum cream colour tinged with Indian red. Pectus cream colour to warm buff, sparsely streaked in front with Indian red. Venter warm buff irrorated with dark Indian red. Legs warm buff sparsely streaked with Indian red, the tibiæ dark Indian red distally. Fore wing varicolorous ; a tuft of Indian red scales at wing-base ; costa tinged with cinnamon buff finely irrorated with dark Indian red; a narrow, bowed (concavity basad), cream coloured antemedial fascia crossing middle of cell; before it, between veins *Cu* 2 and *A* 2 some ochraceous orange; distal half of cell dark Indian red, with a cartridge buff glossy discocellular streak ; below distal half of cell dark Indian red mixed with fine *blackish* irroration, the opalescence of the underlying wing-membrane producing a "*blackish violet*" effect ; a *whitish* postmedial fascia, bowed (concavity apicad) from costa to vein *R* 5, thence oblique (but not quite straight) to middle of inner margin, accentuated distally by a contiguous shade of buffy olive with fine fuscous irroration ; a subterminal fascia of interneural velvety blackish brown dots, succeeded by *whitish* patches ; between veins *R* 4 and *M* 2 the subterminal spots are obsolescent; the buffy olive shade beyond the postmedial here extends to the termen and encloses a small Indian red patch ; a narrow, weak, buffy olive shade relieved with cream colour before the warm buff termen ; fringe cream colour, chequered interneurally with warm buff and occasionally a few blackish brown scales ; inner margin with a projection of Indian red scales, succeeded by two similar projections, that at the tornus being darker. Hind wing cream colour tinged with warm buff, cream colour before termen. Underside cream colour ; fore wing cinnamon buff along costa, with some dark irroration postmedially, apically, and below the cell, the upperside colouring also producing an effect of dark shading ; hind wing with some sparse dark Indian red irroration and some dark shading postmedially between costa and vein *Rs*.

Expanse 31 mm.

♀. Similar, but lacking much of the dark shading; the tuft at base of fore wing cream colour; the colour before the antemedial fascia ochraceous orange to orange rufous; distal half of cell mahogany red; a cream coloured prominent tuft of scales on discocellulars; postmedial fascia obsolescent, hardly distinguishable; succeeding area lightly shaded with yellow ochre. Underside uniformly cream colour, with fuscous shading subterminally, terminally, and at apex.

Expanse 40 mm.

Holotype ♂ and allotype ♀: Solwezi, ♂ 3. iii. 1917, ♀ 19. iv. 1914.

Genus DOLLMANIA, nov. (Pl. VII. fig. 4.)

Palpus stout, porrect, little longer than diameter of eye. Antenna pectinate in both sexes, pectinations only gradually decreasing in length distally. Frons with a distinct longitudinal ridge rounded at the top (not sharp). Wings long, termen evenly bowed, the curve continuing, with little trace of tornus, along inner margin to wing-base. Fore wing with veins *R* 2 + *R* 3 anastomosed for about half their length, *R* 3 to costa at apex, rarely to termen at apex; *R* 5 + *M* 1 anastomosed at base only; hind wings with veins *Sc* and *Rs* to costa; accessory cell moderate, bar sharply oblique, veins *M* 2 + *M* 3 shortly but distinctly anastomosed at their bases, termen deeply bowed.

Abdomen: distal margin of 8th segment in ♂ modified and strongly chitinised.

Type of genus, *Dollmania plinthochroa*, Tams, sp. n.

♂. Palpus mahogany red to brick red with a purplish sheen. Antennal shaft similarly coloured, pectinations honey yellow. Head, thorax, pectus, and legs mahogany red to brick red with a faint purplish sheen. Abdomen dorsally and ventrally cartridge buff to light buff tinged with brick red. Fore wing mahogany red varied with bands of brick red with a purplish sheen, and scattered indistinct patches of buff yellow, the latter particularly marked beyond end of cell and along subterminal fascia; an antemedial and postmedial series of undulating fasciæ, prominent by virtue of the arrangement of the scales, resulting in a glossy effect; a buff yellow discocellular lunule, outlined with mahogany red; subterminal fascia consisting of a series of oblique mahogany red dashes edged distally with buff yellow, and not in alignment. Hind wing light buff tinged with buff yellow and lightly suffused with brick red. Underside light buff tinged with buff yellow, lightly suffused with brick red, the hind wing paler than the fore wing; faint traces of bowed subterminal fasciæ on both.

Expanse 62 mm.

♀. Similar. Expanse 76 mm.

Holotype ♂: Baluba District, 20. ix. 1913.

Allotype ♀: Mumbwa, 5. xi. 1913.

I regard also the following species as belonging to *Dollmania*: *Mallocampa marwitzi*, Strand, *Mallocampa reussi*, Strand, *Metanastria cuprea*, Distant, *Pachymeta purpurascens*, Aurivillius, and *Pachymeta flavia*, Fawcett.

Limacodidæ.

Rhypteira hyperocha, sp. n. (Pl. VII. fig. 10.)

♂. Palpus bone brown, cinnamon buff inwardly and ventrally. Antennal shaft cinnamon buff shaded with bone brown, pectinations honey yellow. Head cinnamon buff, finely streaked with bone brown. Thorax cinnamon buff, patagium, tegula, and crests shaded and edged with bone brown. Tergum cinnamon buff with bone brown streaking. Pectus cinnamon buff with bone brown streaking. Venter cinnamon buff heavily shaded with bone brown. Legs cinnamon buff streaked with bone brown, the fore femur with the long hair-scales tinged with orange buff. Fore wing sepia, glossy; pattern disconnected, the courses of the fasciæ difficult to follow; a bone brown shade between middle of costa and cell, apparently continuing as an oblique dentate antemedial fascia to inner margin at one-third, the most noticeable dentation being one with its point terminad, between lower edge of cell and inner margin; a bone brown dot at end of cell; postmedial fascia bone brown, oblique from costa at three-fourths to vein *M* 2 at two-thirds, thence doubtfully traceable to middle of vein *Cu* 2, between which and inner margin are two prominent dentations, the second of which is obsolescent on the side nearer the inner margin. Hind wings buffy brown to sepia, glossy, with tilleul buff spots at vein ends, and a patch of bone brown at anal angle. Underside uniformly buffy brown to sepia.

Expanse 40 mm.

Holotype ♂: Solwezi, 21. xii. 1918.

EXPLANATION OF THE PLATES.

PLATE VI.

Gynanisa maia daula, Tams, subsp. n., ♂.

PLATE VII.

Fig. 1. *Chrysopsyche pyriphlecta*, Tams, sp. n., ♂.
Fig. 2. *Chrysopsyche pyriphlecta*, Tams, sp. n., ♀.
Fig. 3. *Pseudaphelia dialitha*, Tams, sp. n., ♂.
Fig. 4. *Dollmania plinthochroa*, Tams, sp. n., ♂.
Fig. 5. *Porthesia apatela*, Tams, sp. n., ♀.
Fig. 6. *Porthesia apatela*, Tams, sp. n., ♂.
Fig. 7. *Polelassothys callista*, Tams, sp. n., ♀.
Fig. 8. *Dasychira ænotata*, Tams, sp. n., ♂.
Fig. 9. *Dasychira ænotata*, Tams, sp. n., ♀.
Fig. 10. *Rhypteira hyperocha*, Tams, sp. n., ♂.

PLATE VIII.

Fig. 1. *Craspia hypolispa*, Tams, sp. n., ♂.
Fig. 2. *Craspia hypolispa*, Tams, sp. n., ♀.
Fig. 3. *Stauropus æschyntela*, Tams, sp. n., ♂.
Fig. 4. *Chadisra beltista*, Tams, sp. n., ♂.
Fig. 5. *Chadisra callitoxa*, Tams, sp. n., ♂.
Fig. 6. *Odontocheilopteryx dollmani*, Tams, sp. n., ♂.
Fig. 7. *Odontocheilopteryx dollmani*, Tams, sp. n., ♀.
Fig. 8. *Stauropus æschyntela*, Tams, sp. n., ♀.
Fig. 9. *Chadisra beltista*, Tams, sp. n., ♀.
Fig. 10. *Chadisra callitoxa*, Tams, sp. n., ♀.

XIX.—*Saltatorial Orthoptera collected by Mr. C. L. Collenette in British Somaliland.* By B. P. UVAROV.

THE collection of Orthoptera made by Mr. C. L. Collenette during his recent journey to the British Somaliland, although not a large one, proved to be of an exceptional interest and containing a number of striking new forms. The present article includes the list of Acrididæ, Tettigoniidæ, and Gryllidæ in the collection, while Mantidæ will be dealt with in a separate paper by Dr. M. Beier.

The majority of specimens were taken at Buran, lat. 10° 13′ N., long. 48° 47′ E., alt. 3000 ft. In the case of other localities, the longitude and the latitude are indicated in the text.

I feel it a pleasure to record my thanks to Mr. C. L. Collenette for paying attention to the collection of Orthoptera in that still practically unexplored country.

Acrididæ.

1. *Platypterna* sp.

Buran, 6.ix.1929, at light, 1 ♂.

2. *Orthochtha bisulcata* (Krauss).

The only female before me, taken at Buran, 16.ix.1929, on grass, does not differ from the typical West African specimens except in the slightly more prominent fastigium and broader antennæ.

3. *Aiolopus thalassinus* (Fabricius).

Sheikh Pass, lat. 9° 56′ N., long. 45° 13′ E., alt. 3000–4000 ft., 29.viii.1929, on vegetation, 1 ♂.

4. *Œdaleus miniatus*, sp. n.

Allied to *O. carvalhoi*, Bol., but differing from all known species by the hind wings red basally.

♀. Small.

Antennæ short, reaching the middle of the pronotum, distinctly flattened.

Face slightly rugulose. Frontal ridge in profile practically straight, forming a rounded angle with the fastigium; its surface sulcate, with an obtuse transverse ridge above the ocellum; margins distinctly raised, obtuse. Lateral facial keels well developed. Fastigium of vertex sloping, much longer than broad; the surface feebly concave; lateral margins sharp, strongly convergent to the apex which is truncate, but there is no carina separating the sulcus of the frontal ridge from the surface of the fastigium. Temporal foveolæ triangular, not sharply defined below. Vertex with a short median carinula between the eyes.

Pronotum with the front margin obtusely angulate; hind angle strongly attenuated, acute, with the margins concave. Median carina well raised, sharp, slightly convex in profile. Lateral carinæ cruciate, distinctly raised in the prozona, replaced by whitish lines in the metazona. Sulci obsolete on the disc. Lateral lobes rugulose and punctured, considerably shorter than deep.

Elytra abbreviated, not quite reaching the end of the abdomen, strongly narrowed to the apex. Discoidal area with a practically straight false vein equally distant from the radial and the ulnar vein. Wings shorter than elytra.

Hind femur relatively short and very broad in the basal portion where the upper carina is expanded.

General coloration typical for the genus, olivaceous-green, with the buff and chocolate-brown pattern. White cruciform design on the pronotum distinct, interrupted in the middle and expanded in the metazona. Elytra with the anal portion greenish; the anterior half with chocolate-brown and pale spots. Wings pale red basally; veins of the coxal margin beyond the middle blackish; other veins also dark and there is a faint suggestion of the membrane being smoky beyond the red portion. Hind femur apple-green; upper outer area in the basal third bright buff, with a blackish spot basally and a blackish apical border; externo-median area with two blackish patches surrounded with buff colour near the base of the lower margin; lower outer sulcus buff with blackish dots in the basal half. Hind tibia buff, spotted with brownish.

Total length 20; pronotum 5; elytra 12·5; hind femur 10 mm.

A single female taken at Shimba Beris, Surud Range, lat. 10° 45′ N., long. 47° 12′ E., alt. 6750 ft., 17.xii.1929, on grass.

A very remarkable species, highly aberrant in the coloration of hind wings, the yellow colour of wings being almost a generic character. In the structure the new species resembles very much *O. carvalhoi*, I. Bol., and both should probably be removed to a distinct genus, but I have no males before me.

5. *Pycnodictya kelleri* (Schulthess).

Buran, at light, 8.ix.1929, 1 ♀; do., 16, 17.ix.1929, on stony ground, 2 ♀ ♀.

The limits and the interrelations of the genera *Chlœobora*, Sauss., *Pycnodictya*, Sauss., and *Humbe*, Bol., are very vague, but the present species appears to fit better into *Pycnodictya* than into *Chlœobora* where it has been included by Schulthess.

6. *Pycnodictya dimorpha*, sp. n.

Allied to *P. citripennis*, Sauss., but the wing-fascia is more narrow, the inner side of the hind femora differently coloured, and the median carina of the pronotum more raised.

♂ (type). Antennæ slender, considerably longer than head and pronotum together.

Face convex, moderately and obtusely rugulose. Frontal ridge slightly constricted below the ocellum, feebly concave round it. Lateral facial carinæ well developed, seen from the front strongly diverging below. Fastigium of vertex moderately sloping forward, longer than broad; the surface very slightly concave and almost smooth; lateral margins low, but distinct. Temporal foveolæ small, indistinct.

Pronotum scarcely rugose. Anterior margin produced into an obtuse angle; posterior angle subacute, but the immediate apex blunt. Median keel well raised, tectiform, seen in profile moderately convex, more so in the prozona, interrupted by the typical sulcus slightly in front of the middle. Lateral lobes densely punctured in the metazona; lower margin sinuate.

Elytra reaching about the middle of hind tibiæ. Reticulation very dense and the membrane coriaceous only up to the apex of the discoidal field; in less than the basal half of the apical portion the reticulation is only moderately dense and the membrane hyaline; the hyaline and sparsely reticulated apical third is not sharply separated from the preceding section. Discoidal false vein slightly bent, nearer to the radial than to the ulnar.

Upper carina of the hind femur with several acute teeth. Lower carina scarcely expanded.

General coloration brownish grey. Elytra with the base, an indefinite fascia, and some spots in the apical third brown. Disc of the wings pale vermilion-red; fascia 2–3 mm. broad, with a very short inward projection corresponding to the radial branch, regularly bent, touching the hind margin; apical part hyaline, with the apical lobe smoky. Hind femur ash-grey on the outer face; above with two indistinct blackish fasciæ; inner side black, with two pale yellow fasciæ beyond the middle, the first one broader, but incomplete. Hind tibia pale yellow, with the base black.

♀ (*paratype*). Considerably more robust than the male and more roughly sculptured, the pronotum bearing some round tubercles mainly along the median keel. Disc of the wings pale yellow, and the apical lobe not smoky.

Total length, ♂ 26, ♀ 39; pronotum, ♂ 6·5, ♀ 8·5; elytra, ♂ 26·5, ♀ 30; hind femur, ♂ 16, ♀ 19 mm.

Sheikh Pass, lat. 9° 56′ N., long. 45° 13′ E., alt. 3000–4000 ft., 29.viii.1929, on vegetation, 1 ♂ (type), 2 ♀ ♀ (*C. L. Collenette*); Somaliland, 1 ♂ (*G. W. Bury*); Somali, 1 ♀ (*Miss F. Gillett*).

Although the disc of wings is differently coloured in the males and in the females, this is either a case of sexual dimorphism or of individual variation, as often observed in Œdipodinæ.

7. *Sphingonotus canariensis*, Sauss.

Buran, 5–9.ix.1929, at light, 3 ♂ ♂, 1 ♀.

Saussure (Prodr. Oedip. p. 208) described this insect at first as a variety of *S. savignyi*, Sauss., but later on (Addit. Prodr. Oedip. p. 84) regarded it as a distinct species.

The types are from Cape Verde islands and the name *canariensis* has been given in mistake, but cannot be altered, although the occurrence of the species in the Canary Islands is not yet proved.

The species has very little relation to *S. savignyi*, differing from it in the more narrow hind wings, practically straight discoidal vein of the elytra, and particularly in the structure of the pronotum, which is strongly constricted in the prozona, with the metazona raised (in profile) well above the prozona, and the median keel gibbose in front of the first sulcus. Hind wings are faintly bluish in *S. canariensis*, which is never the case in *S. savignyi*.

S. canariensis is known to me by specimens from St. Vincent, Cape Verde, and from a number of localities in the Sudan.

8. *Sphingonotus savignyi*, Sauss.

One female taken two miles south of Berbera, on surface of coral sand and rock, 15.viii.1929.

9. *Sphingonotus atropurpureus*, sp. n.

Differing from all known species by the coloration of hind wings and by the undulated upper carina of the hind femora.

♀. Antennæ filiform, longer than head and pronotum together.

Face vertical. Frontal ridge in profile somewhat convex between the antennæ and very slightly concave in the middle third; viewed from the front it is widened between antennæ, constricted below the ocellum and obsolescent towards the clypeus; the surface punctured, concave at the ocellum and below it, where the margins are well raised. Lateral facial keels well developed. Fastigium of vertex sloping forward, imperfectly marginated, the surface slightly convex along the middle and slightly concave at the sides. Temporal foveolæ indistinct.

Pronotum constricted in the prozona, which is moderately gibbose between the transverse sulci; the sulci deep. Front margin strongly crenate. Metazona nearly twice as long as prozona with the shoulders prominent; hind angle about 90°; hind margins undulated. Median carina slightly indicated near the front margin of the prozona and on the whole of metazona. Lateral carinæ absent. Lateral lobes about half again as high as they are long; lower front angle obtuse; lower margin straight, feebly ascending forward; hind lower angle right, broadly rounded.

Elytra extending well beyond the apex of the abdomen, fairly broad, with the apex obliquely truncate. Reticulation very dense up to the apex of the discoidal field, but the membrane does not become transparent until the apical quarter. Discoidal vein well developed, sinuate, somewhat approaching the radial in the apical portion. Interulnar field broad, without a definite false vein.

Hind femur with the upper carina expanded and strongly undulated.

General coloration pale brownish ochraceous, mottled with brownish. Elytra with indefinite small brown spots. Wings black, with purplish tinge at the base; the apical third hyaline. Inner side of the hind femur pale yellow; knee with a blackish semilunar spot on the inside. Hind tibia dirty white, with brownish streaks on the outside.

Total length 29; pronotum 6; elytra 30; hind femur 14 mm.

One female, taken at Buran, 27.ix.1929, on rocky ground.

The coloration of the hind wings and the shape of hind femora in this remarkable species are unique within the genus, while in the general habitus and in the dense reticulation of elytra the new species reminds of a *Thalpomena*. Indeed, there is a close resemblance between *S. atropurpureus* and *Thalpomena schulthessi*, Uv. (described as a *Vosseleria*, 'Konowia,' ii. 1923, p. 3), also from the Somaliland, but the latter has a different structure of the pronotum and of the hind femora, apart from being much smaller.

10. *Vosseleriana somali*, Uv.

Two females, Buran, 9.ix.1929, at light.

The species has been described by me ('Konowia,' ii. 1923, p. 2) from "Somali" without more exact locality. The male still remains unknown.

The genus *Vosseleriana* has been founded by me (Bull. Min. Agric. Egypt, no. 41, 1924, p. 31, footnote) on *Helioscirtus fonti*, Bol., and the specimens of *V. somali* collected by Mr. Collenette being well preserved I am able to state definitely that the species is a true *Vosseleriana*.

11. *Helioscirtus collenettei*, sp. n.

Strikingly different from the known species by the banded hind wings and undulated upper carina of hind femora.

♀. Antennæ fine, somewhat longer than head and pronotum together.

Face practically vertical. Frontal ridge low, feebly expanded at the ocellum, narrowed both above and below it, obsolescent near the clypeus; the surface slightly convex near the fastigium, feebly concave at the ocellum; margins feebly raised in the median portion. Fastigium of vertex strongly sloping forward, imperfectly marginated; surface slightly convex along the middle and slightly concave at the sides. Temporal foveolæ imperfectly defined.

Pronotum well constricted in the prozona, which is gibbose between the sulci. Front margin strongly crenate. Median carina practically obsolete throughout, indicated by a scarcely perceptible smooth line. Metazona nearly twice the length of the prozona, almost flat; the surface uneven; shoulders obtusely prominent; hind angle acute, with the margins undulated. Lateral lobes considerably shorter than high, with the lower margin ascending in front.

Elytra with the venation in the basal two-thirds fairly dense, but the membrane semi-hyaline. Discoidal vein well developed, feebly sinuate, approaching the radial vein, but not touching it. Interulnar area with an incomplete false vein. Venation of hind wings somewhat less regular than in the type of the genus (*H. moseri*, Sauss.).

Hind femur with the upper carina high and strongly undulated, lowered just before the knee.

Coloration pale ochraceous-brown. Antennæ with blackish rings. Elytra with the basal fourth ochraceous-brown, and another of a paler shade beyond the middle. Wings bluish with an almost straight fascia running from a point beyond the middle of the front margin to the hind margin, but not reaching the latter and scarcely bent inwards at the hind end. Hind femur on the inside black, with a pale preapical wing; the outside with an indistinct brown fascia in front of the preapical constriction. Hind tibiæ bluish, with brownish spots.

One female (type) from Buran, on sand, 3.xii.; one female, do., 6.xii.; one female, do., at light, 9.ix.1929.

12. *Acrotylus insubricus* (Scopoli).

Buran, 19.ix.1929, on stony ground, 1 ♂; do., 31.xii.1929, at light, 1 ♂.

Very slender form with the wing-fascia obsolete. It is known to me from Persia and Turkestan as well, but I am not clear as to its taxonomic value.

13. *Pœcilocerus vittatus* (Klug).

Sheikh Pass, lat. 9° 56′ N., long. 45° 13′ E., alt. 3000–4000 ft., on vegetation, 1 ♂.

14. *Chrotogonus* spp.

One pair from Sheikh Pass, and another pair from Einad, Al Hills, apparently representing two species, but the systematics of this genus are in an appalling state, and it is impossible to identify species with any degree of certainty.

15. *Allaga lacerta* (Burr).

Buran, 8.x.1929, 1 ♀ ; 7.xii.1929, 1 ♂ ; at light.

The male has two faint yellowish stripes along the pronotum ; the abdominal tergites are blackish behind, and the hind femora somewhat blackened along the edges of the externo-median area.

16. *Allaga parvula*, Ramme.

Buran, 7.xii.1929, 1 ♂, 1 ♀, at light.

17. *Sphodromerus* sp.

Marojeh, Al Hills ; lat. 10° 54′ N., long. 48° 59′ E., alt. 2250 ft., 8.xi.1929, 1 ♀.

A large species, with well-developed elytra, purplish wings, and distinct, though irregular, lateral pronotal keels. Probably new, but I abstain from describing it from a single example.

18. *Thisœcetrus cœrulescens*, Stal.

Buran, 5–9.ix.1929, 1 ♂, 4 ♀ ♀, at light.

19. *Bibulus brunni* (Giglio-Tos).

Buran, 22.ix.1929, 1 ♂, at light.

SURUDIA, gen. nov.

A member of Calliptamini probably allied to *Acrophymus*, Uv.

Strongly rugose. Antennæ feebly compressed, slightly incrassate in the apical half. Face vertical ; frontal ridge in profile straight. Fastigium of vertex strongly sloping, forming a broadly rounded angle with the frontal ridge ; lateral margins well raised ; surface with irregular carinulæ. Temporal foveolæ concave, with sharp, but very irregular margins. Eyes oval, seen sideways not projecting above the head ; their height equal to the subocular distance ; interocular distance twice the width of the frontal ridge between antennæ. Pronotum with numerous short sinuated carinulæ; the disc convex passing gradually into the lateral lobes; median carina low, but sharp, depressed between the first and the second sulcus, deeply cut by all sulci; lateral carinæ indicated by short sinuated carinulæ, irregular; metazona slightly shorter than prozona; hind angle rounded-obtuse. Prosternal tubercle low, transverse, very obtusely conical. Mesosternal interspace much broader than one of the lobes; metasternal interspace strongly transverse. Elytra short, strongly widened behind. Hind femora broad; upper carina serrate; lower carina expanded beyond the middle. Valvæ of the ovipositor short, blunt, the lower ones with strong obtuse teeth.

20. *Surudia loboptera*, sp. n.

♀. Antennæ shorter than head and pronotum together.

Face strongly rugose. Frontal ridge feebly widened from the fastigium towards the ocellum, somewhat narrowed below the latter, and very slightly widened again towards the clypeus; its margins raised, smooth, but irregular; the surface feebly excavated near the ocellum, with coarse punctures and shorter carinulæ. Fastigium of vertex transverse, with well-raised, but irregular margins; the surface of the whole vertex with numerous short sinuate carinulæ.

Pronotum densely covered with short sinuate carinulæ and elongate tubercles. Lateral keels represented by a series of such carinulæ, subparallel in front of the first sulcus; strongly diverging between the first and the third sulcus; in the metazona they are very irregular and begin nearer to the middle than the hind ends of the corresponding sections in front of the typical sulcus.

Elytra broadly oval, broadest behind the middle, with the apex rounded-truncate and shallowly excised slightly in front of the radial veins which are straight and form approximately the middle axis of the elytron. Wings very small, with a few thick veins.

Abdomen rugulose, with a low median keel.

Coloration dark brown, mottled with blackish. Hind femur with the lower sulcus and the inner side red, the latter with a large elongated black spot near the upper edge beyond the middle; the spot is followed by a pale yellow fascia; knee black on the inside, with the knee-lobe yellow. Hind tibiæ yellow, with black-tipped spines.

Two females from Shimba Beris, Surud Range, lat. 10° 45′ N., long. 47° 12′ E., alt. 6750 ft., 17.xii.1929, on grass.

There can be no doubt that this curious grasshopper belongs to a new genus of Calliptamini, but its affinities cannot be determined more exactly until the male is known.

Tettigoniidæ.

21. *Diogena fausta* (Burmeister).

Berbera, 24.viii.1929, 1 ♀, at light.

22. *Phaneroptera albida* (Walker).

Berbera, 26.viii.1929, 1 ♂, at light.

23. *Eurycorypha* sp.

Buran, 8.ix.1929, 1 ♂; 24.ix.1929, 1 ♀; at light.

Gryllidæ.

24. *Liogryllus bimaculatus* (De Geer).

Buran, 12.ix.1929, 1 ♀, at light.

25. *Phæophilacris abyssinica*, Saussure.

Buran, 15.ix.1929, 1 ♂, at light.

I am obliged to Dr. L. Chopard for the determination of this species.

XX.—*A new Species of* Anacridium (*Orthoptera*, Acrididæ) *from Arabia.* By B. P. Uvarov.

Captain Bertram Thomas has recently sent to the British Museum a collection of insects from the Central Southern Arabia, comprising, amongst other orders, a few specimens of Orthoptera, one of which proved to represent a remarkable new species of *Anacridium*, strikingly different from the three species hitherto known in this genus.

This discovery suggests that the Orthopterous fauna of Arabia must contain a high percentage of species, and probably even genera, unknown to science. It is to be hoped that Captain Bertram Thomas will be able to continue his explorations in this interesting region.

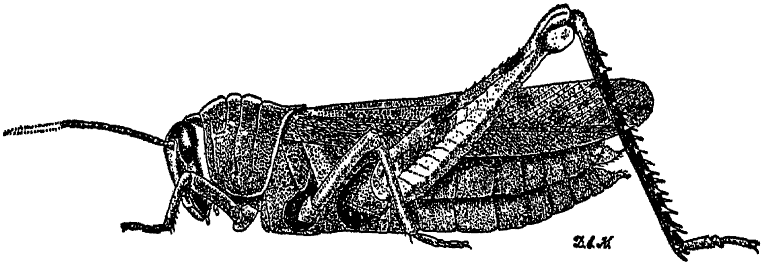
Anacridium arabicum, sp. n.

♀. About the size of *A. ægyptium*, L., but more robust and with shorter elytra and wings, which are not banded, but uniformly infumate throughout.

Frontal ridge scarcely widened above the ocellum, broadly sulcate below it.

Pronotum more gibbose in the prozona than in *A. ægyptium*; the crest higher in profile and deeply cut by the sulci in the prozona; in metazona the crest is low and slightly concave in profile. Metazona considerably shorter than the prozona, obtusely angulate behind. The surface of the whole pronotum covered with more distinct tubercles and wrinkles than in *A. ægyptium*. Prosternal tubercle short and distinctly conical.

Elytra relatively broad and short, extending only a short way beyond the end of the abdomen; the apex parabolic.



Anacridium arabicum, sp. n.

General type of coloration as in the darker specimens of *A. ægyptium*. Antennæ buff. The crest and the hind margin of the pronotum very pale buff, almost whitish. Elytra with a few indefinite brownish spots. Wings uniformly infumate throughout. Hind femur pale buff, with the following markings dark grey: a patch occupying nearly the whole upper basal half of the externo-median area; basal, median, and preapical band on the upper areas; the semilunar spots of the knees; and the spinules along the upper median and the upper external carinæ; the underside of the femur is of sepia-colour. Hind tibia dark steel-grey, with an ivory-white spot at the base behind; the spines pure white, with black tips. Hind tarsi purplish red.

Total length 64; pronotum 15; elytra 50; hind femur 32 mm.

Described from a single female, Central Southern Arabia, Qara Mts., Gurthunat, 2950 ft., 12.ii.1930 (*Bertram Thomas* and *Ali Muhammad*).

XXI.—*New Helicoid Snails from the Mohave Desert.*—IV.

By S. Stillman Berry, Redlands, California.

In early March of 1929, Prof. Edmund C. Jaeger, of Riverside Junior College, and Mr. William H. Thorpe, of the University of Cambridge, organized an informal collecting-trip to Death Valley and some adjacent portions of the Mohave Desert, which the writer was invited to join. The special aim was an investigation of the life of some of the highly concentrated salt-pools of the region, but where possible various members of the party searched for snails. Few of the stations examined proved fruitful, but at three of them snails were taken in fair numbers. These, which include one fine species new to science, are dealt with in the present paper, and opportunity is taken to include another new form brought in by Prof. Jaeger from one of his other trips, together with a quite unique small species sent in just as the paper goes to press by Prof. L. G. Ingles of Bakersfield Junior College. This last, being from Kern County, serves materially to extend the area known to be inhabited by this genus.

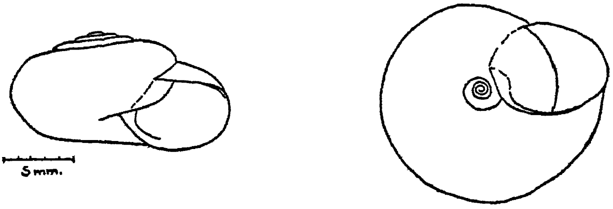


Fig. 1. Fig. 2.

Micrarionta melanopylon, sp. n. (type).

Micrarionta (*Eremarionta*) *melanopylon*, sp. n. (Figs. 1 & 2.)

Description.—Shell rather thin, of moderate size, depressed, the spire low-conic; whorls $4\frac{1}{2}$ to $4\frac{3}{4}$, convex, regularly expanding; suture well marked; last whorl descending parietally. Aperture rounded, oblique, its deflection from the vertical varying between 40° and 50° in the specimens measured. Peristome slightly thickened; little expanded parietally, but more distinctly so below and with a weak columellar reflection. Umbilicus funicular, permeable to the apex, and moderately wide, being contained from 6 to $6\frac{2}{3}$ (usually a trifle over 6) times in the diameter of the shell.

Spiral sculpture wanting, the body of the shell smooth save for the numerous growth-lines and the papillation forthwith to be described. Embryonic shell at first nearly smooth, very weak concentric wrinklings appearing on the latter part of the first fraction of a whorl, this state abruptly giving way for another full whorl to a heavy sculpturing of coarse, rather crowded, hyphen-shaped papillæ, as a rule distinct, separate, and showing arrangement in the usual obliquely descending series, but in some specimens at first showing a tendency to coalesce or even slightly to anastomose. On the later whorls the papillæ are smaller, more distant, more rounded, and eventually become weaker and weaker, although they or their traces may sometimes be detected even on the upper surface of the body-whorl. Lower surface of body-whorl practically smooth.

Periostracum thin and with a somewhat waxy lustre in fresh specimens, the colour apparently much as has been described for related species, and with the usual spiral band of Bistre above the shoulder about 1 mm. wide, flanked on each side by a slightly narrower pale area.

Measurements.—Caliper-measurements of five mature shells are as follows :—

	Maximum diameter.	Minimum diameter.	Altitude.	Diameter of umbilicus.	Number of whorls.
	mm.	mm.	mm.	mm.	
Paratype..	16·0	13·2	8·4	2·6	4¾
Paratype.	15·5	13·1	8·0	2·5	4½
Paratype.	15·4	12·8	8·2	2·5	4⅔
Type ...	14·6	12·3	8·0	2·2	4¾
Paratype.	14·4	12·3	7·4	2·4	4⅔

Type.—Cat. No. 7073 of the author's collection. Paratypes No. 7074 of the same collection; others to be deposited in the collections of Mr. Allyn G. Smith, the San Diego Museum of Natural History, and the Academy of Natural Sciences of Philadelphia.

Type-locality.—On west side of Black Canyon near mouth, 9 miles north of Hinkley, San Bernardino County, California; 8 mature and 12 immature shells, all dead and for the most part well bleached, taken among black basalt rocks on the mountain-side; Edmund C. Jaeger coll., 7 Oct., 1928.

Remarks.—This species is of somewhat commonplace type, but of interest as our first snail from this region of the Desert, nor does it, in spite of its lack of conspicuous distinguishing features, appear referable to any named form. In general aspect it most resembles *M. rixfordi*, Pilsbry, and *M. cætotis*, Berry, but the umbilicus widens more rapidly than in the former and it differs from both in lacking the peculiar retiform embryonic sculpturing peculiar to that group. *M. argus* (Edson) is geographically a nearer neighbour, but has a more capacious aperture and is a materially smaller species.

The specific name chosen is derived from *μέλας*, black, and *πύλη*, gateway, and finds its significance in the name of the canyon and mountain range which the species inhabits.

Micrarionta (*Eremarionta*) *micrometalleus*, sp. n.
(Figs. 3 & 4.)

Description.—Shell small, thin, fragile, very low-conic to sub-discoid; whorls usually $4\frac{1}{4}$, quite strongly convex, only moderately widening as they progress, the suture strongly marked; last whorl somewhat shouldered and moderately descending parietally. Aperture rounded, moderately to rather strongly oblique, its deflection from the vertical about 40°. Peristome barely thickened and hardly expanded even at the columella. Umbilicus wide and well-like, its diameter on the average about $\frac{1}{5}$ that of the shell.

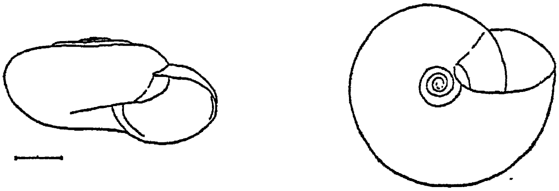


Fig. 3. Fig. 4.

Micrarionta micrometalleus, sp. n. (type).

Spiral sculpture wanting; embryonic shell smooth and hyaline for the first fraction of a turn, then suddenly covered, as far as the first major resting-stage, by numerous small, rather elongate, pointed papillæ arranged in forward-slanting lines, but so close together (on the later portions even more or less confluent) that the effect under low magnification is sometimes almost like minute scales; remainder of shell everywhere covered above and below by a minute granular papillation, rendered to a large degree irregular and indistinct by the numerous heavy and rather uneven lines of growth, which become especially coarse and prominent just back of the aperture.

Periostracum of fresh shells thin, pale Wood-Brown above, a lighter Avellaneous on base, only weakly lustrous, with a narrow, indistinct, more or less interrupted, Buffy-Brown band above the periphery; texture horny rather than porcellaneous. Animal Hair-Brown, deepening on tentacles, back of the head, and sole-margin to Chætura Black.

Measurements.—Caliper-measurements of five mature shells are as follows:—

	Maximum diameter.	Minimum diameter.	Altitude.	Diameter of umbilicus.	Number of whorls.
	mm.	mm.	mm.	mm.	
Paratype..	10·2	8·7	5·4	2·0	4⅛
Paratype..	10·0	8·5	4·3	2·1	4¼
Paratype..	9·9	8·4	4·6	2·1	4¼
Type	9·6	8·2	4·6	1·7	4¼
Paratype..	9·0	7·6	4·3	1·6	4+

Type.—Cat. No. 7071 of the author's collection. Paratypes No. 7072 of the same collection; others to be deposited in the collections of Mr. Allyn G. Smith, the Academy of Natural Sciences of Philadelphia, and the British Museum (Natural History).

Type-locality.—Base of granite rock-slide in the El Paso Range, 3½ miles south of Petrified Forest, Kern County, California; many bleached dead shells in slide, with 3 mature and 1 immature living snails found in æstivation sealed to rocks over 2 feet down; no water or moisture evident; L. G. Ingles, 27 Dec., 1929.

Remarks.—This, the smallest Mohavean helicoid thus far described, is further characterized by the much-depressed, almost discoid form, the comparatively slowly enlarging whorls, the well-like umbilicus, the obscure banding, the papillose surface, and the coarse growth-striæ, which give a rough crude appearance to the upper surface of the shell. It is a very distinct and characteristic species, apparently not closely allied to any other we know. From the extreme western part of the Desert, it is likewise the first of its genus to be discovered in Kern County.

The specific name proposed is derived from μικρός, small, and μεταλλεύς, miner, and has reference to the minute size of the species and its delving habit.

Micrarionta (*Eremarionta*) *avawatzica*, sp. n.

(Figs. 5–8.)

Description.—Shell of moderate size and thickness; low-conic in outline; whorls 4½ to 4¾, strongly convex, high-shouldered, with well-grooved suture; last whorl strongly descending parietally. Aperture rounded or sometimes almost subtriangular, due both to the shouldering and to a certain squaring below the columella, strongly oblique, the deflection usually 50° or more. Peristome hardly at all thickened or expanded, save for a moderate flare at the umbilicus, which does not greatly affect the circular outline of the latter. Umbilicus of moderate width, funicular, narrowly permeable to the apex, its diameter contained in that of the shell about 6½ to 7 times.

Fig. 5.

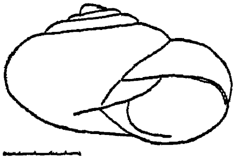
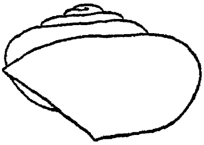


Fig. 6.

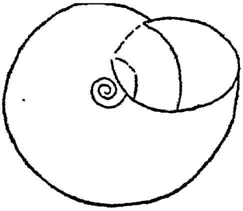


Micrarionta avawatzica, sp. n.

Fig. 5.—Paratype.

Spiral sculpture wanting; embryonic shell with first half-whorl initially smooth and vitreous, then incompletely concentrically wrinkled, the wrinkles breaking up on the succeeding full whorl into coarse pustulations which at first show some evidence of arrangement in forward-slanting lines, but are soon more irregular with such degree of confluence and anastomosis as to give the effect of an irregular and incomplete reticulum rather than true papillation. The principal whorls subsequent to this have the appearance of being covered with low scattered papillæ superimposed on a minutely wrinkly-papillose surface, the whole pattern becoming nearly obsolete on the body-whorl both above and below. Lines of growth numerous and very strong on the post-embryonic whorls, more notably on the earlier ones.

Fig. 7.

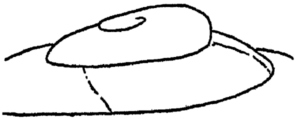


Micrarionta avawatzica, sp. n.

Embryonic shell after the first half-turn remarkable for being strongly inflated, particularly on one side (*cf.* fig. 8), so that it appears to be set into the subsequent coil somewhat obliquely.

Periostracum in fresh shells with a peculiar satiny or waxy lustre, most evident on the upper surface and along the sutures, where the surface has an aspect under the microscope almost as if wet: ground-colour of base and peripheral part of body-whorl Cartridge-Buff to Tilleul-Buff, deepening on the upper part of the whorl and the spire to Vinaceous-Buff, with a conspicuous supraperipheral band of Chestnut about 1 mm. wide, bordered by a very pale area just above and below.

Fig. 8.



Micrarionta avawatzica, sp. n. Slightly oblique posterior view of apex.

Measurements.—Caliper-measurements of ten mature shells are as follows:—

	Maximum diameter.	Minimum diameter.	Altitude.	Diameter of umbilicus.	Number of whorls.
	mm.	mm.	mm.	mm.	
Paratype....	15·4	13·0	8·5	2·4	$4\frac{3}{4}$
Paratype....	15·4	13·0	9·0	2·3	$4\frac{3}{4}$
Paratype....	15·2	13·0	8·5	2·3	$4\frac{1}{2}$
Paratype....	15·1	12·5	9·1	2·1	$4\frac{2}{3}$
Paratype....	15·1	12·7	8·6	2·1	$4\frac{1}{2}$
Stat. VIII...	17·3	14·4	9·6	2·5	$4\frac{3}{4}$
Stat. VIII...	16·4	13·4	9·4	2·4	$4\frac{3}{4}$
Stat. VIII...	16·1	13·7	9·4	2·3	$4\frac{3}{4}$
Stat. VIII...	15·7	13·1	9·2	2·2	$4\frac{3}{4}$
Stat. VIII...	15·0	12·6	9·2	2·1	$4\frac{3}{4}$

Type.—Cat. No. 6884 of the author's collection. Paratypes No. 6885 of the same collection; others to be deposited in the collections of Mr. Allyn G. Smith, the Academy of Natural Sciences of Philadelphia, the San Diego Museum of Natural History, and the British Museum (Natural History).

Type-locality.—Stat. II., rocky point west of road in pass at junction of Barstow and Silver Lake roads, 5 miles south of Cave Spring, Avawatz Mts., San Bernardino Co., California; 3 adults and 3 immature alive, 11 mature and 20 immature dead shells, the living ones in a small rock-slide just north of the point, many of the dead shells scattered about on the surface; S. S. Berry, W. H. Ott, and C. B. Cherry Coll., 1 March, 1929.

Additional Locality.—Stat. VIII., rock-slide at base of hill to east of road nearly opposite Stat. II., Avawatz Mts., Calif.; 13 mature and 18 immature shells, 2 of the latter with animals; S. S. Berry, A. H. Bliss, et al., 3 March, 1929.

Remarks.—This very distinctive and pretty species seems closely allied to none of its fellows hitherto described. Distinctive characters to note are the peculiar satiny sheen, the very oblique aperture, the shouldering, and especially the peculiar eccentric swelling of the embryonic shell. The Ferriss Death Valley Expedition of 1922 also collected *Micrarionta* in the Avawatz Range, but encountered nothing resembling this species.

Helminthoglypta mohaveana, Berry, 1927.

1927. *Helminthoglypta mohaveana*, Berry, Ann. & Mag. Nat. Hist. (9) xviii. p. 492, figs. 3 & 4.

Additional Locality.—Stat. XI., base of rocky cliffs on right bank of Mohave River just above Victorville, San Bernardino Co., California; living snails found sparingly in æstivation among and under loose rocks; S. S. Berry and W. H. Thorpe coll., 4 March, 1929.

Note.—This series, taken across a gap in the mountains from the type-station of *mohaveana*, proves not safely distinguishable from my *H. riparia* (*ibid.* ser. 10, vol. i. p. 278) and indicates that the features relied upon to distinguish these two related forms were based on inadequate, not fully characteristic material of the first-mentioned, and only doubtfully hold in wider series. Present probabilities therefore are that *riparia* must either be reduced to bare subspecific rank or dropped from our lists altogether, despite the apparently complete isolation of the original habitats noted.

XXII.—*Notes on some new Ordovician Trilobites from Girvan.* By F. R. Cowper Reed, Sc.D., F.G.S.

[Plates IX. & X.]

Since the publication of the author's monograph on the Ordovician and Silurian Trilobites of the Girvan area between the years 1903 and 1914 *, the large amount of work which has been done on this group by American and other palæontologists has shed much light on many of the species there described. But with the exception of two new Girvan forms described by the author in 1926 *, no accounts of other species from that district appear to have been published. Recently Mr. James Begg, of Shettleston, has sent the author various specimens for identification, and amongst them are some new and interesting forms which are here described. A later opportunity will be taken to make some remarks on certain of the other species and to correct the generic or specific reference of some previously described.

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* Reed, "Lower Palæozoic Trilobites of Girvan" (Palæont. Soc.), pts. 1-3, 1903-1906, and Supplement, 1914.

Illænus roemeri, Volborth, var. nov. *transversalis*. (Pl. IX. figs. 1, 1 *a*, 1 *b*.)

There is one perfect pygidium of a species of *Illænus* from South Thraive in Mr. Begg's collection which differs from the typical *I. shallochensis*, Reed †, of the Whitehouse (and Drummuck ?) Groups in its proportions, being transversely semicircular in shape and considerably broader than long, instead of being semi-elliptical and longer or as long as broad. The surface of the pygidium is gently convex from front to back, making a regular low arch, and round the posterior edge there is a scarcely perceptible marginal hollowing of the surface corresponding to the doublure on the inferior surface. The axis is broad, but practically obsolete on the surface, being only marked by short notches on the anterior edge of the pygidium and by very short shallow depressions close behind them ; it has no independent convexity except on the margin and no trace of axial furrows ; in width it is more than one-third that of the pygidium. The anterior edge of each lateral lobe is rather swollen and raised, with a weak depression behind it extending out as far as the obtusely-rounded fulcrum, which is situated at about half the width of the lateral lobe ; the lateral angles of the pygidium are truncated and gently rounded, making an angle of about 140° with the front edge. The general surface of the pygidium is pitted all over with small irregularly distributed pits and has several somewhat irregular lamellose transverse "terraced" lines crossing it, both of these features occurring also in *I. shallochensis*. But we may strongly doubt if it belongs to this species, and we may much better regard our specimen as representing a variety of *I. roemeri*, Volborth, as described by Holm * and more recently by Warburg † from the *Leptæna* Limestone of Sweden, for it agrees in its relative proportions, shape, obsolete axis, and ornamentation.

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* Reed, Trans. Roy. Soc. Edinburgh, vol. liv. pt. 3 (no. 17), 1926, pp. 735–737, plate, figs. 1–6. (*Glaphurus radialis*, sp. n., and *Lichas transversus*, sp. n.)

† Reed, *op. cit.* pt. 2, 1904, p. 68, pl. x. figs. 2–5.

Dimensions :—Length 31 mm., width 46 mm., height 8 mm.

Cybele (*Cybeloides*) *loveni*, Linnarrson, var. nov. *radiata*.
(Pl. IX. figs. 2, 2 *a*, 2 *b*.)

A pair of free cheeks belonging to the head-shield of a new variety or species of *Cybele* in Mr. Begg's collection from South Thraive (Drummuck Group) lie in close contact on the same piece of rock, but slightly displaced from their correct relative positions ; some broken fragments of the thorax of apparently the same specimen occur in association, and also a much smaller imperfect head-shield of *Cybele* (*Cybeloides*) *loveni* var. *girvanensis*, ‡, which is a closely-allied form.

The free cheeks of the new variety are large and semicircular, with a strongly swollen convex surface ; the outer edge of the cheek forms a regular semicircular curve ; the genal angle is not preserved. The subhemispherical surface of the cheeks is ornamented with numerous small tubercles which tend to be elongated radially and arranged in irregular radial lines, and in the neighbourhood of the eye are usually connected by short broken radial ridges which at the base of the eye-stalk are very distinct, equidistant, devoid of tubercles, and number 10–12. The eye, which is situated about half the length of the cheek, is elevated on a short constricted neck or stalk, and has a very high conical surface bearing numerous extremely minute lenses. The border of the cheeks consists of a rounded convex band, and is smooth except near its anterior end, where a few small isolated tubercles lie along it, and the free-pointed anterior tongue, which here curves suddenly forward and slightly downwards, also bears a group of smaller tubercles on its surface at the bend and two or three large prominent spinose tubercles on the outer edge at its front end. The marginal furrow is continuous and rather deep.

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* Holm, Rev. Ostbalt-Silur. Trilob. Abt. 3, 1886 (Mem. Acad. Imper. Sc. St. Petersb. xxxiii. no. 8), p. 125, t. ix. fig. 11.

† Warburg, "Trilobites of the *Leptæna* Limestone in Dalarne" (Bull. Geol. Inst. Upsala, vol. xvii. 1925), p. 108, pl. i. figs. 26–29.

‡ Reed, *op. cit.* pt. 3, 1906, p. 126, pl. xviii. figs. 1–4 ; *ibid.* Suppl. 1914, p. 40, pl. vii. fig. 4, 5.

The chief point of difference from *C. loveni*, var. *girvanensis*, lies in the radial ornamentation of the surface, which indicates another species or, at any rate, a new variety. It belongs undoubtedly to the subgenus *Cybeloides*, Slocom, which has been recognized by the author * as including *C. loveni*.

Troedsson † has described a variety of *Cybeloides iowensis*, Slocom, as var. *sulcatus* from the Cape Calhoun beds of Greenland, but he makes no mention of any Girvan species or any European member of the subgenus.

Pliomera (*Pliomerops*) *girvanensis*, sp. n. (Pl. IX. figs. 3, 3 *a*.)

Head-shield semicircular, rather flat, slightly arched in middle near front. Glabella subquadrate, somewhat narrower at base, subtruncate in front, with sides subparallel and very slightly arched outwards; axial furrows strong, narrow; anterior end of glabella with pair of very short, weak, slightly oblique furrows; three pairs of lateral furrows present, arising equidistantly on axial furrows, of equal length and strength, but not parallel, extending inwards fully one-third across glabella on each side; anterior pair of lateral furrows arising a very short distance behind lateral angles of front end of glabella, straight, directed obliquely backwards; middle pair of lateral furrows straight, horizontal, situated at half the length of the glabella; posterior pair of lateral furrows arising very near occipital furrow, straight, directed obliquely forwards; anterior and middle lateral lobes of glabella of equal size; posterior lobes smaller and much narrower. Cheeks somewhat flattened, lower than glabella, horizontally extended or gently arched down; genal angles rounded. Occipital furrow strong; occipital ring with pleural portion widening somewhat laterally, and meso-occipital portion slightly arched forward. Eyes situated in middle of cheeks, at about half the width of glabella from axial furrows and opposite middle lateral furrows, of moderate size, with groove on eye-lobe. Free cheeks small. Frontal border of head-shield narrow, rounded, marked off by strong narrow marginal furrow. Surface of head-shield coarsely granulated; cheeks granulated and finely pitted.

Dimensions.—Length of head-shield 6 mm., width 12 mm.

Remarks.—There is only one specimen of this new species in Mr. Begg's collection, and it comes from the Stinchar

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* Reed, Geol. Mag. vol. lxv. 1928, pp. 72-76.

† Troedsson, "Middle and Upper Ordovician Faunas of Northern Greenland," pt. 2 (Medd. om Grönland, lxxii. 1928), p. 62, pl. xvi. fig. 12.

Limestone of Aldons Quarry; it has the glabella and right cheek well preserved, but the free cheeks are missing. As regards its affinities, it seems much like *P. barrandei* (Billings) *, which occurs on several horizons in Newfoundland and is allied to *P. canadensis*, Billings †, of the Chazy and Lenoir Formations. The species, however, which seems most closely allied to this new Girvan form is *Pliomera dactylifera*, Poulsen ‡, from the Upper Canadian of North West Greenland, which its author describes as having a pygidium closely similar to that of *P. barrandei* (Billings), a species which Raymond § referred to his subgenus *Pliomerops*.

Phacops (*Pterygometopus*?) *quarrelensis*, sp. n.
(Pl. X. figs. 3, 3 *a*.)

Pygidium semielliptical, somewhat subquadrate, and slightly truncate behind, gently convex from side to side, somewhat bent up in middle of posterior margin, without definite border. Axis conical, nearly reaching posterior margin, tapering rather rapidly to subacute point, annulated to tip by about 12 rings, of which only the first 8–9 are distinct and have strong interannular furrows deepening at sides, the last 3–4 rings being very faint; each ring bears an irregular median row of coarse granules. Lateral lobes gently arched down, with inner half somewhat flattened; fulcrum weak, situated about halfway out; pleuræ 9–12 in number, of which the first 7–8 are strong and rounded, correspond with the axial rings and bear an irregular series of coarse granules, but are not furrowed; all the pleuræ flatten somewhat and decrease in height towards their ends, which do not quite reach the margin of the pygidium, leaving a narrow, smooth, undefined border; first 5–7 interpleural furrows strong, the rest very weak. Doublure thick, rounded, of equal width all round.

Dimensions.—Length 10 mm., width 16 mm.

Remarks.—Two pygidia of this species from Quarrel Hill (Drummuck Group) have been sent me by Mr. James Begg. We cannot refer them to any previously-described species, the absence of furrows on the pleuræ being peculiar, though they are likewise absent in *P.* (*Pt.*) *alifrons*, Salt.[*], from the Welsh Ordovician. We must therefore place this pygidium in a new species which may be termed *quarrelensis*. Our figured specimen has the shell somewhat broken away along the right-hand side and posterior margin, exposing the impression of the rounded doublure, and part of the left-hand lobe is also missing; otherwise it is in good preservation. The other specimen is nearly as perfect and practically of the same size. If we attribute considerable importance to the pygidium, particularly to the absence of pleural furrows on it, we may feel that there is considerable reason for establishing a new subgenus for *P. alifrons* and this Girvan species. Additional reason for so doing may be found in the development of the lateral lobes and furrows of the glabella of *P. alifrons*, which differ in some respects from the typical *Pterygometopus*. But we may hesitate at present to separate them from it.

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* Billings, Palæoz. Foss. Canada, 1865, i. p. 288, fig. 277 *a*, *b*.

† Raymond, Seventh Ann. Rept. Vermont Geol. Surv. 1910, p. 238, pl. xxxvi. figs. 10–13, pl. xxxviii. fig. 14.

‡ Poulsen, "Cambr., Ozark., and Canadian Faunas of N.W. Greenland" (Medd. om Grönland, lxx. 1927), p. 397, pl. xx. figs. 33–37.

§ Raymond, Ann. Carnegie Mus. vol. vii. no. 1, 1910, p. 75, text-figs. 4–8; *id.*, Bull. Mus. Comp. Zool. lxvii. no. 1, 1925, p. 153.

Phacops (*Monorakos*) *asteroideus*, Reed.
(Pl. X. figs. 1, 1 *a*, 1 *b*, 2, 2 *a*.)

The pygidium of this species was described by the author in 1914[†] from the Drummuck Series, and the species was founded on it. Mr. James Begg has been fortunate to find at South Thraive one complete specimen with the head-shield attached to the anterior part of the thorax slightly displaced from the pygidium, which is attached to the posterior segments; there is also another head-shield with part of the thorax attached to it in his collection, so that we are now able to give a complete description of the species and to determine that it should be referred to the subgenus *Monorakos* rather than to *Dalmanitina*, as was originally suggested and recently maintained[‡] by the present author.

Head-shield semicircular, obtusely pointed in front; genal angles nots pined; lateral and posterior margins of head-shield meeting at about 75°. Glabella broadly subclaviform, expanding rapidly in width to the front end, the sides diverging from the base at about 60°–75°; frontal lobe triangular, more than half length of glabella, with anterior lateral angles projecting laterally and cut off by facial sutures; first lateral lobe large, triangular, with anterior lateral angle of about 45°, reaching inwards more than one third width of glabella; second lateral lobes narrow, extending about half length of first lobes along axial furrows, directed obliquely forwards, narrowing somewhat inwards,

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[*] Salter, Mon. Brit. Trilob. pt. 1, p. 33, pl. i. fig. 32.

[†] Reed, *op. cit.*, Suppl. 1914, p. 53, pl. viii. figs. 10–12.

[‡] Reed, Geol. Mag. vol. lxiv. 1927, p. 341.

incompletely separated at outer ends from first lateral lobes; third lateral lobes nodular, rather far out, connected by low rounded band across base of glabella. First lateral furrows strong, complete, straight, obliquely directed backwards, at right angles to axial furrows; second lateral furrows rather weak, incomplete, being nearly obsolete near axial furrows, obliquely directed forwards, at right angles to axial furrows; third lateral furrows deep at outer ends and directed at first slightly backwards, curving round front of nodular basal lobes to end in deep pits, but then becoming much weaker and directed forwards; occipital furrow forming deep pit on each side behind basal lobes, then weakly continued in slightly convex-forwards curve across base of glabella. Meso-occipital ring slightly swollen at sides; pleuro-occipital segment widening laterally, marked off by strong furrow curving forwards laterally. Fixed cheeks small, very narrow behind eyes, with semicircular eye-lobes, but widening considerably to genal angles. Facial sutures bending forwards and outwards behind the eyes in strong sigmoidal curve to cut lateral margins. Genal angles obtuse, blunt, without spines. Eyes semilunate, very large and elevated, reaching from first lateral furrows nearly to occipital furrow; lens-bearing surface large, high, nearly vertical, with 30–35 rows of lenses, having 10 lenses in middle rows. Free cheeks small, nearly wholly occupied by eyes. Border of head-shield narrow, obtusely pointed in front of glabella.

Thorax with convex axis, occupying middle third of width; axial rings with lateral swellings; pleuræ with strong diagonal furrow. Surface finely granulated.

Pygidium transversely semioval, with slightly produced short blunt? mucro; axis conical, subcarinate, about one-fourth the width of pygidium and four-fifths its length, not reaching posterior margin, composed of 8–10 complete rings, of which only the first seven are distinct and separated by fine doubly sigmoidal furrows arched back in the middle; lateral lobes flattened for inner half, then arched down gently, composed of 6–7 flat pleuræ separated by well-marked nearly straight furrows, only the first 3 pleuræ corresponding with axial rings; surface of pleuræ with short, median, oblique furrow in outer half; interpleural and pleural furrows die out before reaching margin; inferior surface of pygidium with thickened edge and wide concentrically-striated fascia of uniform width.

Dimensions.—Length of head-shield c. 15 mm., width c. 30 mm., length of pygidium c. 12 mm., width c. 19 mm.

This species [*], which was referred by the author in 1914 to *Dalmanitina*, may be placed in *Monorakos*, Schmidt [†], with greater certainty than in *Pterygometopus*, and we may point out its close relationship to *M. schucherti*, Troedsson [‡], and *M. wimani*, Troedsson [§], from the Cape Calhoun beds of Greenland, especially in its glabellar characters, though in our species the first and second lateral lobes are more distinctly separated. The subgenus *Monorakos* is a link between *Chasmops* and *Pterygometopus* [‖]. The pygidium of *Monorakos*, as exemplified by *M. eboraceus*, Clarke [¶], and the closely-allied *M. intermedius* (Walcott) [**], from the Trenton Formation, seems to be distinct from that of the typical *Pterygometopus*, and the pygidia of these American species show noticeable points of resemblance to our species. But the two subgenera are difficult to separate. As regards the subgenus *Dalmanitina*, of which the type is *Dalmanites socialis*, Barrande, McLearn [††] used the term in too wide a sense, but, as previously [‡‡] remarked, the pygidium which he referred to *D. weaveri*, Salt. [§§], appears to be much like that of *M. asteroideus*. The subgenus *Monorakos* has not been recorded previously from the British Isles.

EXPLANATION OF THE PLATES.

PLATE IX.

Fig. 1. *Illænus roemeri*, Volborth, var. nov. *transversalis*. Pygidium. × 1½. Drummuck Group, South Thraive, Girvan.
Fig. 1 *a*. Ditto. Side view of same specimen. × 1½.
Fig. 1 *b*. Ditto. Posterior view of same specimen. × 1½.
Fig. 2. *Cybele* (*Cybeloides*) *loveni*, Linn., var. nov. *radiata*. Right free cheek, from above. × 3. Drummuck Group, South Thraive, Girvan.
Fig. 2 *a*. Ditto. From front. × 3.
Fig. 2 *b*. Ditto. Left free cheek of same head-shield, from side. × 3.
Fig. 3. *Pliomera* (*Pliomerops*) *girvanensis*, sp. n. Head-shield. × 4. Stinchar Limestone Group, Aldons Quarry, Girvan.
Fig. 3 *a*. Ditto. Anterior marginal view of same specimen. × 4.

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[*] Reed, *op. cit.*, Suppl. 1914, p. 53, pl. viii. figs. 10–12.

[†] Schmidt, Bull. Acad. Imper. Sc. St. Petersburg, xii. no. 4 (1886), p. 414.

[‡] Troedsson, *op. cit.* 1929, p. 78, pl. xix. figs. 17–20.

[§] *Ibid.* p. 79, pl. xix. fig. 16.

[‖] Reed, Geol. Mag. dec. 5, vol. ii. 1905, p. 10.

[¶] Clarke, 'Palæont. Minnesota,' vol. iii. 1894, p. 728, figs. 48, 49.

[**] *Ibid.* p. 727, text-figs. 45–47.

[††] McLearn, Mem. 137 Geol. Surv. Canada, 1924, p. 169, pl. xxvii. figs. 7–10.

[‡‡] Reed, Geol. Mag. vol. lxiv. 1927, p. 341.

[§§] Reed, *op. cit.* dec. v. vol. vi. 1909, pp. 69–73.

PLATE X.

Fig. 1. *Phacops* (*Monorakos*) *asteroideus*, Reed. Head-shield and anterior segments of thorax of complete individual. × 2½. Drummuck Group, South Thraive, Girvan.
Fig. 1 *a.* Ditto. Head-shield of same specimen. × 2½.
Fig. 1 *b.* Ditto. Pygidium and posterior segment of same specimen. × 2½.
Fig. 2. Ditto. Head-shield and part of thorax of another specimen. × 2½. Same horizon and locality.
Fig. 2 *a.* Ditto. Side view of same specimen, showing eye. × 2½.
Fig. 3. *Phacops* (*Pterygometopus?*) *quarrelensis*, sp. n. Pygidium. × 3. Drummuck Group, Quarrel Hill, Girvan.
Fig. 3 *a.* Ditto. Posterior marginal view of same specimen. × 3.

XXIII.—*The Status of the extinct Frog,* Lithobatrachus.

By H. W. PARKER, B.A.

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IN a recent number of these 'Annals'[*] the author described a new genus of frogs from the Miocene of Germany. The type and unique species of this genus had previously been referred by Noble[†] to the genus *Hyla*, and more recently this author[‡] has criticised the reasons which led me to recognise it as a distinct genus and has re-affirmed his original opinion. Unfortunately, Noble had no opportunity to re-examine the unique specimen when drawing up his criticism, and his assertions, made from his notes and recollections only, are frequently erroneous. Consequently it seems desirable to draw attention to the many points of his criticism which do not bear close scrutiny.

First of all, in discussing the nature of the imprint which I have suggested to be that made by the exoccipitals and first vertebra, Noble endeavours to show that this imprint lies too far posteriorly to have had any connection with the skull. To this end he makes certain generalisations concerning the position of the occipital condyles relative to a line drawn between the posterior ends of the articulars, stating that they lie "entirely or for the greater part posterior to this line" in many fossorial Salientia and in "narrow-headed aquatic types, such as *Xenopus tropicalis*," but that "broad-headed terrestrial forms, such as *Hyla* or *Rana*, and even aquatic species with a broad head, such as

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[*] (10) iv. 1929, pp. 270–277.
[†] Ann. Mus. Novitates, ccciii. 1928, p. 9.
[‡] *Op. cit.* cccci. 1930, pp. 9–11.

Pipa pipa have the greater part of the condyles anterior to the same line." From these premises he goes on to state that, since the fossil "is unquestionably a broad-headed form," the atlanto-occipital articulation must have lain on the same level as the mesial ends of the clavicles and that the imprint which I described as that of the first vertebra cannot possibly be the impression of that structure. The fossil certainly seems to have been "broad-headed" (though dorso-ventral crushing has probably exaggerated this, if one may judge from the fact that the imprint of the lower jaw actually crosses that of the upper *) and the ratio of the width between the centres of the posterior ends of the articulars to the length from this line to the tip of the snout is 1·57. The same ratio for *Pipa pipa* is 1·31 and for *Xenopus lævis* (3 specimens) 1·11 to 1·18. Examination of the skeletons of nineteen different species of the so-called "broad-headed" genus *Hyla* shows, however, that in fifteen (79 per cent.) the skull is actually narrower than that of the "narrow-headed" *Xenopus* (ratio 0·93 to 1·09)! The occipital condyles, moreover, are by no means constantly anterior to the line connecting the posterior corners of the angulars and they lie most markedly behind this line ($\frac{1}{6}$ to $\frac{1}{4}$ the length of the skull) in one of the few species (*Hyla arborea arborea*) in which the skull is relatively broad ($\frac{\text{width}}{\text{length}}$ 1·11 to 1·2). Again, it has been found that the skulls of twenty-six out of thirty species of *Rana* are narrower than the "narrow-headed" *Xenopus* (ratio 0·8–1·08), and that, in at least eleven the condyles are behind, and not in front of, the level of the articulars.

Consequently it is obvious that the attempt to determine the position of the first vertebra by a consideration of the broadness or narrowness of the skull is based on a fallacy and is valueless. Noble further attempts to discount the value of the alleged first vertebra by asserting that it "does not agree in detail with that of either *Pipa pipa* or *Xenopus tropicalis*," a fact which is scarcely to be wondered at, since the fossil is certainly not referable to either of these species. He also points out that the impression does not agree with that of "other possible structures such as the larynx or hyoid," and yet, in the very next sentence, he assures us that the imprints which seem to be associated with it are "directed posteriorly like thyroid processes of the hyoid and not laterally like transverse processes of a vertebra"! It may be added that the transverse processes of the anterior vertebræ are by no means always lateral, but, as in *Pipa pipa*, may be very definitely directed obliquely backwards.

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* Parker, *loc. cit.* fig. 1.

The second character on which Noble lays stress is the scapula. He claims that this structure must have been considerably longer than is shown in my figure, and states that the depression in the fossil which I have regarded as caused by the mesial extremity of the bone may have been made by a "pre-glenoid," and that there is another depression, caused by an acromion, between this point and the clavicle. "This is of interest," he declares, "for it definitely excludes the species from the Discoglossidæ, Pipidæ, and probably from the Palæobatrachidæ." A most careful re-examination of the specimen merely serves to show that, again, Noble's premises are wrong. The impression of the scapula on the left side is better defined than on the right, and here the mesial end of the bone has produced two deeper depressions, the posterior widely separated from the clavicle, and the anterior separated from it by a narrow ridge measuring about two-thirds of its width; there is quite certainly no "shallow depression," such as Noble claims between this anterior imprint and the clavicle. The two impressions correspond very closely indeed with the ridge bordering the *superficial articulation* (posterior) and the ridge on that portion of the scapula which in the Discoglossidæ and Pipidæ extends into the "procoracoid region" and assists in the formation of the anterior margin of the glenoid cavity (anterior). The dimensions of the imprint of the left side exactly correspond with those of the right, despite the fact that the mesial end of the latter is widely separated from the clavicle, and consequently it seems very probable that these two impressions give a true idea of the actual size and proportions of the scapula. Measurements show that the bone was slightly less than once and a half as long as broad, and about three-fifths the length of the procoracoid. These figures may be compared with those for other groups:—

	Ratio: $\frac{\text{length}}{\text{distal width}}$.	Ratio: $\frac{\text{length of procoracoid}}{\text{length of scapula}}$.
* Pipidæ (4 genera)......	1·1–1·7	2–4·2
* *Palæobatrachus* (3 spp.) .	1·3–1·5	1·2–2
Lithobatrachus	1·4	1·7
* Discoglossidæ (3 genera)	1·0–1·4	2–2·3
* *Hyla* (20 spp.)	1·6 or slightly more.	1·0 or slightly less.

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* Procter, Proc. Zool. Soc. London, 1921, pp. 197–214.

It is thus apparent that the scapula of *Lithobatrachus* is rather longer than in most of the Pipidæ and Discoglossidæ, and much shorter than in the genus *Hyla*; it agrees closely with that of *Palæobatrachus*.

The character which is of primary importance in the relegation of the species to *Hyla* is the terminal phalanx, and the presence or absence of an intercalary phalanx or cartilage. The imprint shows that the terminal phalanx was curved, but this is far from diagnostic; the important point is to discover whether or not an intercalary was present. Noble states that in most instances where a *Hyla* has decomposed on a flat surface, the intercalary is plainly visible from beneath. Under these conditions, if the intercalary was bony, a definite short imprint would have been made between the distal and penultimate phalanges. No such imprint is visible; the distal margin of the penultimate and the proximal margin of the terminal phalanx are clearly defined, as shown in my figure, and between the two is a narrow ridge, wider to the left than the right. Noble asserts that this segment between the two phalanges is too thick to be a syndesmosis, and the inference, if that were true, would be that the space was originally occupied by a cartilaginous intercalary. It is, however, obvious from the angle which the longitudinal axes of the penultimate and terminal phalanges subtend, that the terminal has been displaced. This in itself is sufficient to render invalid any conclusions based on the width of the segment between the two; add to this the fact that the segment at its narrowest measures less than 0·15 mm., and it will be seen that the evidence in favour of an intercalary cartilage is negligible.

The imprints of the skull are admittedly poor, and the comparison with *Xenopus* that was made in describing *Lithobatrachus* and which Noble characterises as "unsound" was known, and stated, to be merely a suggestion; no diagnostic importance was attached to any feature of the palate except the teeth, which are very definitely present. The clavicle was compared with those of *Xenopus* and *Hyla* and a greater similarity to the former was noticed; Noble neglects the latter comparison and, *à propos* the former, remarks that "the coracoids and scapulas (*sic*), which are better indicated, have no resemblance to those of *X. lævis* and *X. tropicalis*." The same, or a similar, remark could be made of many different genera, even of the same family. As an example, the scapulæ of *Xenopus* and *Pipa* might justifiably be compared and regarded as similar, yet the clavicles and coracoids are vastly different; *Lithobatrachus* was not even definitely assigned to the same family as *Xenopus*. Noble further states that what I have considered as the dilated end of the clavicle "differs in texture from the adjacent bone and . . . may have been a replacement or cast of the procoracoid cartilage." Actually the extreme tips of the clavicles are represented by bony fragments (stippled in my figure) which do not differ in texture from the distal fragments of the same bone; the dilated portion of the clavicle is represented by an impression only.

Lastly, Noble casts doubt on the interpretation of certain imprints of the pelvic girdle; his criticism takes the form of a suggestion that what was considered the right pubis might be the imprint of a fractured piece of the head of the femur and the dogmatic assertion that the "imprint of the alleged left pubis was made by a fractured piece either of the ilium or of the puboischium." Such an assertion, unsupported by any confirmatory evidence is of no value. Noble further considers the two imprints to be of very unequal size, but, if allowance be made for the obvious distortion which has occurred in this region and for the fact that the imprint of the right pubis is partly obliterated by that of the femur, there is considerable symmetry, and comparison with the pelvis of *Xenopus* * is certainly very suggestive.

In summing up his views, Noble stresses the undoubted difficulty of correctly interpreting a fossil of this nature and asserts that the species shows no affinities with the Pipidæ; the differences from this family which he cites were all equally clearly and definitely stated in my consideration of the relationships of the fossil (p. 275). In considering its affinities to the Palæobatrachidæ he asserts that these rest on the assumption that the sacrum was double and that there is no "proof" of this assumption. There is equally no "proof" that the species possessed intercalary phalanges, and, whereas there is considerable evidence in favour of the double sacrum hypothesis, as well as confirmatory circumstantial evidence in other characters, there is no evidence in favour of the presence of intercalary phalanges and little other evidence suggestive of relationship to the Hylidæ. Noble also stresses the differences from *Palæobatrachus* (which led to its description as a distinct genus), adding that this is "the only valid genus in the family." This cannot be accepted as an argument against the inclusion of *Lithobatrachus* in the Palæobatrachidæ, for to do so would be to pre-suppose that our knowledge of the family is complete, which is absurd.

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* Parker, *loc. cit.* fig. 3.

XXIV.—*Preliminary Account of a new Genus and Species of Plesiosaur.* By W. E. Swinton, B.Sc., F.G.S.

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Early in 1928 the skeleton of a plesiosaur was discovered in working the limestone of a quarry at Harbury, Warwickshire, owned by Messrs. Greaves, Bull, and Lakin, Ltd. After careful removal from the deposit the specimen was generously offered to the Trustees of the British Museum by the directors of the parent cement organization, Messrs. Portland Cement Selling and Distributing Co., Ltd., and it has been developed in the workshops of the Geological Department.

The examination of the prepared skeleton shows that in many important features it is unlike any plesiosaur so far described, and I propose, therefore, to give it a new generic and specific name.

Genus Macroplata *, nov.

Genotype.—Macroplata tenuiceps, sp. n.

Diagnosis.—Sauropterygia with a long skull and a long neck tapering from back to front. Cervical vertebræ moderately long, centra broader than high and narrow across the neurapophyses. Articular faces only slightly concave, and the anterior and posterior margins of the centrum rugose. Dorsals smooth and with constricted centra; articular faces not deeply concave; neural spines moderately high; transverse processes wholly supported by the arch. Sacral vertebræ with large rib-facets on the centra, and large and stout ribs. Caudals with rugose anterior and posterior margins to centra, articular faces more deeply cupped than the other vertebræ.

Pectoral girdle with very long and comparatively narrow coracoids which have considerable preglenoidal extension. Posterior margins of coracoids with a deep indentation, so that the postero-lateral margins appear produced. Clavicles slight, not meeting in the middle line. Interclavicle strong, concave in front, and meeting the coracoids behind.

Pelvic girdle with pubes as long as broad, and long ischia; both with long symphyses in the middle line.

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* Gr., Μακρος=large or long; πλατη=a blade, and, especially in the plural, the shoulder-blades.

Macroplata tenuiceps, sp. n.

Diagnosis.—As for the genus.

Holotype.—Skull and nearly complete skeleton. British Museum, Geol. Dept. no. R. 5488.

Horizon and Locality.—Lower Lias, *Schlotheimia angulata* zone, Messrs. Greaves, Bull, and Lakin's cement-quarry at Harbury, near Leamington Spa, Warwickshire.

Dimensions :—Total length 465 cm. (15 ft. 3 in.). Length of skull 58 cm. (1 ft. 11 in.). Length of neck 124 cm. (4 ft. 1 in.). Length of trunk 161 cm. (5 ft. 3½ in.). Length of tail 122 cm. (4 ft.).

General Description :—Skull. Although the skull is complete, not all its characters can be clearly determined. The palatal surface is obscured anteriorly by the mandible, which has been pressed upon it, and the posterior part, where visible, is fractured. Seen from above, it presents no features of particular interest beyond the long, narrow, sub-triangular shape; the comparatively large orbits and vacuities; and the elevated median line extending all along the skull. On the palatal surface the only portion in good condition is the area surrounding the post-palatine vacuities. The basisphenoid is short and narrow, and the parasphenoid is trowel-shaped, with the "handle" of the trowel lying just posterior to the vacuities and the diamond-shaped "blade" lying partly between and partly anterior to them. It follows that the vacuities, which are small, are turned outwards. The teeth are of the usual plesiosaurian character, and vary slightly in their size, which increases from the front of the snout to the thirteenth tooth and then decreases so that the smallest teeth lie in the posterior part of the maxilla. There are about thirty teeth on each side of the upper jaw. The mandible is strong, with a symphysis 18·5 cm. long. The skull is approximately half the length of the neck.

Vertebral column. The main characters of the vertebræ have been given above. The atlas and axis are well preserved, and in addition there are 27 cervicals, which increase slightly in size from before backwards, the last being 52 mm. long, 67 mm. high, and 97 mm. broad. The centra are slightly rugose, especially at the anterior and posterior articular margins. The division of the rib-facet into two is gradual and only completed at the 25th cervical. There are 5 + 19 pectorals and dorsals, the vertebræ being larger than the cervicals and the centra almost smooth; the sides of the centra are concave, the maximum depth of the concavity being 12 mm. Most of the neural spines are missing and those present are imperfect, the longest portion being only about 8 cm. Probably they were quite high and directed only slightly backwards. There are 4 sacrals and 30 caudals, although probably one or two of the latter are missing. These vertebræ show no features worthy of additional comment.

Shoulder-girdle. This is represented by the entire left coracoid, most of the left scapula, the glenoidal and preglenoidal part of the right coracoid, traces of the inner ends of both clavicles, and the complete interclavicle. The length of the coracoid is 51 cm. and its average width, excluding the glenoidal region, is 12·7 cm. In general appearance the coracoid is long and narrow, and has a large preglenoidal portion which tapers only slightly, and at its anterior end measures 10 cm. across. On the posterior margin of the coracoid there is a triangular indentation nearly two inches deep and two inches across at the outer side. As a result, the postero-lateral angle of the coracoid appears bent outwards. Of the other pectoral bones the interclavicle is the most striking. It is a strong bone measuring about 22 cm. broad and 13 cm. in antero-posterior direction. It is concave anteriorly and meets both coracoids posteriorly. In the middle of the posterior line, however, it is strongly indented, so that a considerable foramen is formed between the coracoids and the interclavicle. Only traces of the clavicles are to be seen. The scapula is incomplete ; it is smooth with an expanded semicircular anterior margin and a somewhat triangular glenoidal end. The ascending process is missing.

Pelvic girdle. As in the pectoral girdle only the left side is seen, and the posterior margin of the ischium is somewhat fragmentary. The outline of the whole bone can, nevertheless, be made out. The pubis is a roughly rectangular plate of bone about 28 cm. long and 30·5 cm. across at its widest (anterior) part. The width of the posterior margin is 24 cm. The ischium as usual is hatchet-shaped, but is long and narrow. At its anterior (pubic) end the width is 24 cm., the over-all width at the posterior end is 10·2 cm., and the length of the bone at its inner symphysial side is 30·5 cm. Ischium and pubis meet on the inner side, so that there are only two obturator foramina in the complete pelvis. The total length of the two bones antero-posteriorly is 61 cm. The obturator foramen is roughly circular, the antero-posterior diameter being 10·2 cm., and the lateral 9 cm. The ilium also is only to be seen on the left side, but it is fragmentary and shows no features of interest. Its length as preserved is 21·6 cm.

Humerus. The humerus is 32·4 cm. long, 7·6 cm. in antero-posterior diameter at the head, and 16 cm. at the distal end. The anterior margin is very slightly convex, the posterior is markedly concave.

Femur. The femur is a rounder and larger bone than the humerus and is slightly longer, measuring 33·3 cm. The antero-posterior diameter of the head is 11 cm. and 16·5 cm. at the distal end. The distal articular end is widely V-shaped in contrast to the rounded form of the humerus. The anterior margin of the femur is slightly convex in the proximal half and concave in the distal part. The posterior margin is concave, but less so than in the humerus.

The tibia and fibula of the left side are present. Both bones are the same length, 10·1 cm., and about the same breadth, 9 cm.

A fuller description of the specimen, with figures, and a detailed discussion of its systematic position and relationships will be published later.

XXV.—*A Review of the Genus* Proagonistes, *Loew* (*Diptera, Family* Asilidæ), *with Descriptions of Eight new Species.*

By S. W. Bromley, M.Sc., Bartlett Tree Research Laboratories, Stamford, Conn., U.S.A.

[Plate XI.]

INTRODUCTION.

The genus *Proagonistes* was proposed by Loew for a South African Asilid to which he gave the name *validus* (Öfvers. af K. Vet.-Akad. Förhandl., xiv. pp. 362, 367, 1858). The specimen from which the description was made was damaged, the antennæ being broken, and Loew was unable to locate the genus with certainty. He finally placed it in the Asilinæ, but commented that it might eventually prove to be a Laphriine.

Austen (Trans. Zool. Soc. London, xix. p. 86, footnote, 1909) showed that *Proagonistes* should be assigned to the Laphriinæ, and also called attention to the fact that certain somewhat anomalous Laphriines possessed the characters differentiating this genus and should also be included. These were :—

Laphria rufibarbis, Fabricius. West Africa (placed in *Hyperechia* in Kertész's 'Catalogus').
Laphria ufens, Walker. Sierra Leone.
Laphria præceps, Walker. Natal.

CHARACTERISTICS OF THE GENUS.

The relationship of *Proagonistes* to other Laphriine genera was rather vague. Kertész first indicated the true relationship by assigning *rufibarbis* to *Hyperechia*. It is probable that to this genus and *Andrenosoma* (*Pogonosoma*), Rondani, on the one hand, and to *Saliomima*, Enderlein, on the other, *Proagonistes* bears its closest affinities.

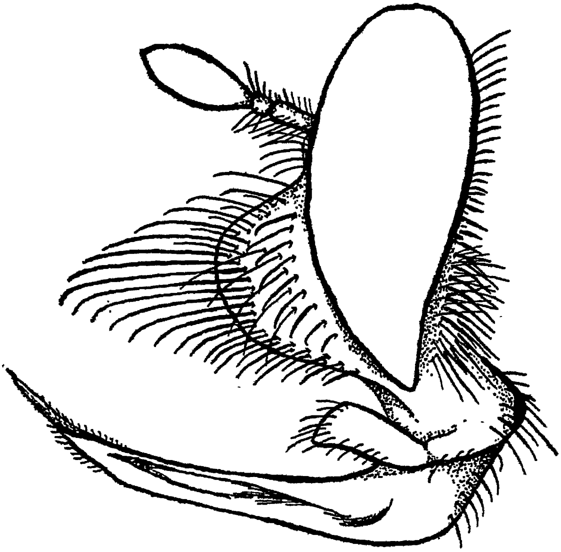
Andrenosoma, of which *Pogonosoma* is considered a subgenus by Miss Ricardo (Ann. & Mag. Nat. Hist. ser. 9, vol. xx. p. 205, August 1927), is common to both hemispheres, leading to *Dasyllis*, Loew, in South and Central America, and to *Hyperechia* on one side and *Proagonistes* on the other in Africa and the Orient. All these genera have the sharp-pointed, slightly upturned proboscis, and the comparatively long tubular ovipositor, showing a common relationship. On the other hand, *Proagonistes* shows relationships also to the Oriental genus *Saliomima*, Enderlein ('Zoologischer Anzeiger,' Jahrg. xliv. p. 243, May 1914), which in most characteristics is closer to *Laphria*.

The following combination of characters obtains in all specimens of *Proagonistes* which I have noted :—

1. The sharp-pointed proboscis, slightly upturned at tip, almost sickle-like, as seen in profile (fig. 1).
2. The prominent facial gibbosity adorned with a heavy mystax.
3. The slightly broadened 3rd antennal segment (as in *Andrenosoma*).
4. The broadened, flattened distal palpal segment, not narrowed as in *Saliomima*.
5. The rather elongate body, not with thick vestiture as in *Hyperechia*.
6. The long, straight, rather slender, but strong legs, without bushy vestiture as in *Hyperechia*.
7. The open first posterior cell—not narrowed or closed as in *Andrenosoma*.
8. The comparatively long tubular ovipositor (fig. 2) similar to, but as a rule longer than, that of *Andrenosoma* and *Hyperechia*; not inconspicuous as in *Saliomima*.

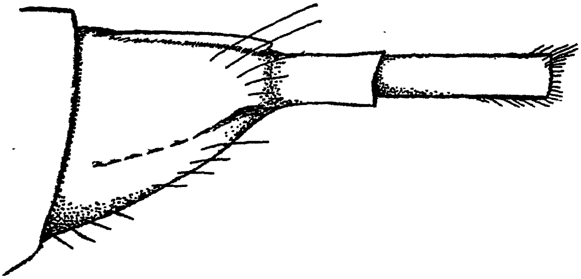
Proagonistes is characterized by the large size of the species. In fact, to *Proagonistes* belong some of the largest, if not the very largest, of the Laphriinæ. The large species from Madagascar mentioned by Austen in 1909, and

Fig. 1.



Head of *Proagonistes athletes*, Speiser. × 12.

Fig. 2.



Ovipositor of *Proagonistes athletes*, Speiser. × 12.

described in the present paper as *gigantipes*, sp. n., measures 45 mm. with the ovipositor broken off, while a large species from Nyasaland reaches a length of 46 mm.

Furthermore, most of the species appear to be mimetic of large aculeate Hymenoptera. A very common pattern in the African species is the dark wings and body contrasting with the long orange-coloured legs, very suggestive of some of the large Psammocharid wasps of the genus *Salius*—a coloration assumed also by other African flies, chief among them the huge Rhinoceros botfly (*Gyrostigma*).

The heavy-bodied Asilid flies of the related genus *Hyperechia* are strongly mimetic of the large Xylocopid bees. The astonishing relationships between *Hyperechia* and *Xylocopa* have been interestingly described by Poulton (Trans. Ent. Soc. London, pp. 121–133, August 1924). These flies are almost invariably found associated with the bees to which they bear resemblance, and in some cases the principal prey of the adult *Hyperechia* is a Xylocopid. Even more remarkable, the adult *Hyperechia* oviposits in the Xylocopid tunnel and its larva lives there, preying upon that of the Xylocopid.

While it is probable that no such relationship exists between *Proagonistes* and *Salius*, it would be very interesting to ascertain whether there is any association between the two genera in addition to the obvious resemblance.

The only instance hitherto published in which *Proagonistes* was taken with prey was first recorded by Dr. (now Sir) Guy Marshall, C.M.G., F.R.S. (Trans. Ent. Soc. London, p. 334, 1902), who lists *P.* probably *præceps*, Walker, as feeding on an aculeate Hymenopteron (*Halictus* sp.).

The sharp sickle-shaped proboscis in this genus suggests a specialized diet of aculeate Hymenoptera. Wherever this type of structure is found in related genera such as *Andrenosoma*, *Hyperechia*, or *Pogonosoma*, the prey chosen is usually Hymenopterous. It seems reasonable to suppose that this type of proboscis with its needle-like point would enable the fly to kill more quickly such prey as a wasp or large bee, thus terminating what might otherwise be a prolonged struggle in which the fly might be stung by its aculeate victim. A blunt truncate proboscis of the type found in *Laphria*, many of the species of which feed more extensively on Coleoptera, would seem to be a less efficient instrument for piercing and killing quickly aculeate prey.

In the hope of obtaining more definite data regarding the habits of the flies of this genus, the writer communicated with Dr. S. A. Neave, of the Imperial Institute of Entomology, who has probably collected more of these flies than any other naturalist, and obtained some very interesting information embodied in letters from which, with Dr. Neave's kind permission, extracts are here quoted.

In regard to the nature of the prey of *Proagonistes*, Dr. Neave states, "I have examined the collection at the British Museum, but have not been able to find any material with prey other than that collected by myself, and this, although limited, is I think interesting. I have records of eight cases of individuals taken with prey. These consist of three specimens of a large species of *Belonogaster*, two large Cicadas, one dragonfly, one Bombyliid, and one Asilid *. I think that the predominance of *Belonogaster* is interesting, because there seems to be a tendency for this type of Asilid to select for its prey the order and in some cases the genus that it itself resembles. This I have found in the case of *Hyperechia*, in which there is a marked tendency to specialize in Hymenoptera, more especially Xylocopid bees."

The flies themselves, continues Dr. Neave, "are essentially woodland or forest insects, and I never found them except in association with trees. I know nothing about their breeding-habits, but should not be surprised if they were somewhat similar to those of *Hyperechia*. They are very powerful insects with a very strong flight, although this is not bullet-like as in the case of *Hyperechia*, which can hardly be seen when on the wing."

Genotype.—*Proagonistes* was erected for the species *validus*, Loew. A careful study of Loew's description and its application to a specimen of *præceps*, Walker, compared with Walker's type, lead me to the conclusion that *validus* and *præceps* are the same species. As Walker's name has priority, the genotype must bear the name *præceps*. The type of *P. validus* was from Caffraria, that of *P. præceps* from Natal.

GEOGRAPHICAL DISTRIBUTION.

Of the seven species heretofore known, all were African. In the present paper, six more African species, a Malagasy species, and one Oriental species are described as new, while one other species recently described under *Lamyra* has been transferred to this genus. A total of sixteen species is therefore now known.

ACKNOWLEDGMENTS.

For material and data that have made possible the preparation of this paper, the writer wishes to thank Major E. E. Austen, D.S.O., Keeper of Entomology in the British Museum, Dr. H. H. Schouteden of the Musée du Congo Belge, and Dr. Kröber of the Hamburg Museum.

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* With one exception (*Proagonistes saliodes*, sp. n.), the captor in each of these cases is a *P. athletes*, Speiser.—E. E. AUSTEN.

Key to the Species.

1. Oriental species .... 2.
African species .... 3.
2. Legs and all vestiture pale reddish yellow; wings yellow with brown apices ...... *auripes*, sp. n.
3. Wings orange-coloured, apex broadly brownish .... *apicalis*, Curran.
Wing blackish or brownish .... 4.
4. Hind tarsi with fine blackish hairs, causing them to appear black above .... 5.
5. Mystax, beard, hairs of pleura, and front coxæ dark yellow; abdomen deep reddish brown with reddish hairs .... *leoninus*, sp. n.
6. Scutellum black with reddish-yellow tip; thoracic dorsum mostly reddish .... *redimiculum*, Speiser.
Scutellum uniformly black.............. 7.
7. Hind femur uniformly reddish or yellowish. 8.
Hind femur more or less black .... 13.
8. Vestiture of head reddish or yellowish .. 9.
Vestiture of head mostly black.......... *pliomelas*, Speiser.
9. Mystax long and thick, straw-yellow; first two segments of abdomen with fine white down on the sides.................. *mystaceus*, sp. n.
Mystax reddish .... 10.
10. Thorax with mostly reddish bristles .... *vulpinus*, sp. n.
Thorax with black bristles.............. 11.
11. Huge species about 45 mm. in length; hind legs extremely long (Madagascar).. *gigantipes*, sp. n.
Species about 30 mm. in length (West Africa) .... 12.
12. Occipital bristles reddish; thorax black .. *rufibarbis*, Fabricius.
Occipital bristles black; thorax black, but with slight brassy tinge and covered with dark tawny down .... *ufens*, Walker.
13. Front coxæ with black hairs, beard black or black with reddish hairs intermingled. 14.
Front coxæ with whitish hairs .... 15.
14. Small species (about 27 or 28 mm. in length); beard black; femora black with extreme apex reddish .... *præceps*, Walker.
Huge species (over 40 mm. in length); beard black with some of the hairs reddish at base; hind femur with apical $\frac{3}{4}$ below and apical $\frac{1}{4}$ above reddish, rest black .... *saliodes*, sp. n.
15. Thorax mostly black .... 16.
Thorax broadly reddish anteriorly and along sides above wings; a reddish line on each pleuron .... *austeni*, sp. n.
16. Hind femur mostly black .... 17.
Hind femur mostly yellowish; apical third above black .... *prædo*, Austen.
17. Large robust species (29–43 mm.); beard reddish .... *athletes*, Speiser.
Smaller, slenderer species (23–31 mm.); beard straw-coloured .... *neavei*, sp. n.

Proagonistes auripes, sp. n.

Male.—Total length 27 mm. Reddish-golden with black markings; legs, proboscis, genitalia, mystax, beard, and all hairs and bristles pale reddish yellow; wings yellow, with apices brown. Bears a superficial resemblance to *Saliomima reinwardti* (Wied.).

Eyes, a small spot on genæ at base of eyes, and basal half of 1st antennal segment black. Rest of antennæ, proboscis, beard, mystax, gibbosity, and occipital bristles pale reddish yellow.

Thorax reddish yellow with concolorous hairs and bristles, but with the following black markings: a heavy mid-dorsal line extending full length of mesonotum; two lateral lines, one on either side of mid-dorsal line, starting behind humeral callus and not quite reaching scutellum; median area of scutellum and a mid-dorsal line through post-scutellum; most of the pleuron black, but with a broad yellow line extending from base of wings very nearly to middle coxa. Wings long, rather narrow, yellow, with apices brownish; veins yellow, except through brown area where they are also brown. Halteres yellow. Legs long, slender, pale reddish yellow, with long slender thickly-set concolorous hairs. Ungues, hind coxa, and a spot on each trochanter black. Scutellum with six long reddish-gold bristles on margin.

Abdomen rather long and slender, reddish yellow and black, with pale reddish-yellow hairs. 1st segment reddish yellow, with anterior border and a broad mid-dorsal line black; 2nd segment reddish yellow, with a black mid-dorsal line, broad at base and tapering posteriorly; 3rd segment black, with a small reddish-yellow spot on either side; 4th and 5th segments black; 6th segment black, with a reddish-yellow spot on the posterior margin. Genitalia reddish yellow, with concolorous hairs.

Holotype.—Male. Malay Peninsula: Perak, Kivala-Kangsar, ii.–iii. 1900. In Hamburg Museum.

It is with considerable hesitancy that I place this species here, as I have not seen the female, which, from the structure of the ovipositor, would indicate more definitely the relationship. However, the structure of the proboscis, antennæ and palpi, the wing-venation, and the long, slender, straight legs are very similar to the corresponding characters in the African species, although in some ways *P. auripes* shows affinity with *Saliomima*, Enderlein. While the proboscis in profile seems to be straighter than in the African species of *Proagonistes*, yet its shorter length and more bulbous base seem to differentiate the species above described from *Saliomima*, where the proboscis is proportionally longer and of more uniform width. In the species of *Saliomima*, also, the palpi are much longer and slenderer, as is also the terminal segment of the antennæ, while the hind femora are somewhat thickened and arcuate, and all the legs are correlatively shorter and stouter than in *Proagonistes*.

Proagonistes apicalis (Curran).

Lamyra apicalis, Curran, Amer. Mus. Novitates, no. 272, p. 6, July 2, 1927; Bull. Amer. Mus. Nat. Hist., lvii. vi. p. 331, June 9, 1928.

Total length 21–28 mm. Characterized by the reddish-yellow wings with brownish tips; the black abdomen (except the ovipositor, which is reddish); the black pleura, with a whitish-pruinose spot above the middle coxa; the mesonotum black and reddish yellow, the markings suggestive of the preceding species; the yellowish palpi and frontal gibbosity. The proboscis is black distally, but reddish yellow at base. The hairs of the front coxæ are white. The legs are black and yellow. All tarsi and the first two tibiæ are reddish yellow. Hind tibia black above, reddish below; tips of all femora reddish, the posterior most narrowly. Rest of posterior femora black. First femur black above, reddish yellow below.

Curran's type-specimen was a female from Belgian Congo (Medje), 1–7. ix. 1910. The writer has seen two other specimens, both from the Musée du Congo Belge—one a female from Mayumbe, 1917, collected by R. Mayné, and a male from Mayumbe, no date, collected by de Briey. The male differs only in having the reddish hairs on the legs longer and more thickly set.

The coloration of the wings and mesonotum are strongly reminiscent of the preceding Oriental species, *P. auripes*.

Proagonistes leoninus, sp. n.

Female.—Total length 31 mm. A robust species, with the legs shorter and stouter than the average. The wings are paler brown than those of most other species, and the abdomen is covered with fine rufous pile. The tarsi are also black above, a character which distinguishes the present species from all others known to the writer.

Black, with reddish or yellowish vestiture. Head, including proboscis and palpi, black. Third segment of antennæ reddish. Palpal hairs reddish. Beard and mystax dull yellowish, latter with a few black bristles and reddish hairs intermingled. Thorax black. Hairs and bristles on pleura and humeral callus, and a few bristles above wings reddish yellow; fine hairs on dorsum black. Scutellum black. Wings pale brownish. Halteres reddish yellow, with paler knobs. Legs with long yellowish hairs on front and middle femora; long hairs on legs elsewhere mainly rufous. Bristles reddish. Ungues black, with reddish bases. Femora black, with apices narrowly reddish. Tibiæ and tarsi reddish, with numerous minute hairs above, making them appear black. Coxal hairs dusky yellow. Abdomen deep reddish, almost piceous, appearing black on casual glance, but covered with a fine rufous pile and numerous minute black hairs on dorsum. Ovipositor dull reddish brown, with fine dark yellow hairs at tip.

Holotype.—Male. San Thomé (*H. J. Snell*). In British Museum (Natural History).

This species has much the appearance of a large *Andrenosoma,* and it must be admitted that the two genera run very close; were it not for the fact that the first posterior cell is so open at the margin, and had I not specimens of *Proagonistes* for comparison, I would have unhesitatingly assigned it to *Andrenosoma.*

Proagonistes redimiculum, Speiser.

Proagonistes redimiculum, Speiser, Deutsch. Ent. Zeitschr., Jahrg. 1914, p. 7.

A small species (15½ mm.) described by Speiser from one female from Cameroon (Tiko near Victoria). It is said to be black, with reddish-yellow head and legs, black wings, and brownish fire-red thorax, with a round blackish spot on either side just above and posterior to the base of the wings, while the scutellum is black with a reddish-yellow tip.

I have not seen this species, but it seems to be so definitely marked as to be easily recognized.

Proagonistes pliomelas, Speiser.

Proagonistes pliomelas, Speiser, Zeitschr. für Hymen. u. Dipt., vii. Jahrg., p. 358, 1907.

Described by Speiser from a female from North Cameroon. This species appears to be closely related to *P. rufibarbis,* Fabr., differing from it in having the third segment of the antennæ slenderer and the hairs on the legs and head mostly black. Length 34 mm.

I have identified three specimens as belonging to this species, although there seems to be a considerable variation in the relative proportion of black and reddish hairs of both the head and the legs. All are females, ranging in length from 34–41 mm. One is in the British Museum and bears the following data:—W. Africa: Ashanti, Obuasi, 18.vii. 1907 (*Dr. W. M. Graham*). "Caught where a bush-path opens on to Railway." The two others are from the Musée du Congo Belge, both collected at Mayumbe, Belgian Congo—one by R. Mayné, 1917, the other by de Briey, no date *.

Proagonistes mystaceus, sp. n.

Total length 31 mm. A black species with brownish wings, reddish legs, black abdomen with whitish down on venter and along sides of first two segments, sixth segment and genitalia reddish; head black with reddish palpi, yellowish-white beard, and long bushy yellow mystax.

Male.—Head black, except palpi and first two joints of antennæ (third missing in case of holotype), which are reddish. Occipital bristles black, with a few yellowish hairs intermingled. Beard yellowish-white, with a very few black hairs. Mystax long, bushy, straw-yellow above, but with a few reddish-yellow hairs below.

Thorax black, with fine yellowish hairs on disc. Black bristles on side above wings, and on margin of scutellum. Pleura and coxæ with yellowish or yellowish-white hairs. Bristles of pronotum black. Coxæ black; femora, tibiæ, and tarsi reddish, with reddish hairs and bristles. Ungues reddish, black at tips. Wings brownish, darkest along veins. Halteres yellow-brown, with pale yellow tips. Tuft of hairs in front of halteres yellowish, with a few black bristles above. Abdomen black, with white hairs on venter and white down on sides of first two segments. Sixth segment and genitalia reddish, and clothed with similarly coloured hair.

Kenya Colony, Samburu, 30. x.–20. xi. 1896 (*C. S. Betton*). Holotype, male. In British Museum (Natural History).

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* In addition to the specimen seen by Mr. Bromley, the British Museum possesses three other examples of this species, viz.:—a male from Ashanti (Kumasi) and two females from the Gold Coast, 1913, all collected by A. E. Evans and presented by the Imperial Institute of Entomology.—E. E. AUSTEN.

Proagonistes vulpinus, sp. n.

Total length 30–40 mm. Related to *P. rufibarbis*, Fabr., but differing in having most of the hairs and bristles of the thorax and abdomen deep reddish, while the ground-colour of the thorax is not so decidedly black, but with more of a reddish hue.

Male.—Black with black wings, reddish legs and genitalia; coxal (1 and 2) hairs yellowish; rest of the coarse vestiture reddish.

Head black, with bulb of proboscis, frontal gibbosity, and antennæ reddish. Palpi black, with reddish hair. Mystax, beard, and occipital bristles rufous. Thorax black, with a deep reddish hue above wings and on pleura. Bristles and coarser hairs reddish; fine hairs on mesonotum black. Coxæ black; front and middle pairs with yellowish hairs, hind coxæ with reddish hairs. Legs deep rufous, with reddish hairs and bristles. Ungues black. Wings deep brown. Abdomen deep black, with long hairs deep reddish and minute hairs black. Genitalia deep reddish, with concolorous hairs.

Holotype, male, San Thomé, 1919–21 (*H. J. Snell*). In British Museum. Paratopotype, male, same data. In British Museum (Natural History).

Proagonistes gigantipes, sp. n. (Pl. XI.)

Total length 45 mm. without ovipositor (missing in case of holotype). Alar expanse 80 mm. A very large blackish species, with extremely long posterior legs. Posterior femur 23 mm.; posterior tarsus 20 mm.

Female.—Antennæ (third segment missing in case of holotype), facial prominence, ventral area at base of proboscis, and complete vestiture of head deep rufous. Rest of proboscis and palpi black. Thorax and abdomen black, with black vestiture. Hairs on first and second coxæ yellowish. Legs rufous, with concolorous hairs and bristles. Halteres with deep reddish stalks and yellowish knobs. Wings deep brown, with light, almost hyaline, area in middle of most cells, except costal, subcostal, and first posterior, which are uniformly brownish in the specimen before me.

Holotype, evidently a female (the ovipositor is broken off), Madagascar, ex coll. W. W. Saunders. In British Museum (Natural History).

This magnificent species is the one to which reference is made by Austen, in Trans. Zool. Soc. London, xix. p. 86, footnote, 1909.

Proagonistes rufibarbis (Fabricius).

Laphria rufibarbis, Fabricius, Systema Antliatorum, p. 157, 1805.
Hyperechia rufibarbis, Kertész, Catalogus Dipterorum, iv. p. 171, 1909.
Lamyra rufibarbis, Curran, Bull. Amer. Mus. Nat. Hist. lvii., p. 331, June 9, 1928.

Total length 31 mm. A blackish species, with rufous legs and the vestiture of the head rufous. The hairs on the first two pairs of coxæ yellowish. Wings deep brown. Halteres light brown. Vestiture of thorax black, of abdomen black, except a few reddish hairs at base of ovipositor, which is also reddish, and long and tubular as characteristic of the genus. The vestiture of the legs is mostly reddish, but there are in the specimen before me some black hairs on the first femora, and the other femora also have some dark hairs. The claws are black.

Described by Fabricius from a specimen from Guinea in de Sehestedt's collection. Curran (*loc. cit.*) records a female from Malela, Belgian Congo (July). The specimen, a female, before me, loaned by the British Museum, bears the data, "Caught on leaf in bush path, Obuasi, Ashanti, West Africa, 4. viii. 1907 (*Dr. W. M. Graham*)."

Proagonistes ufens (Walker).

Laphria ufens, Walker, List Dipt. Brit. Mus., ii., p. 372, 1849.

This species was assigned to *Proagonistes* by Austen (*loc. cit.*) in 1909. I have not seen the species, but from Walker's description believe it to be closely related to *P. rufibarbis*. It is described as being 11 lines in length, black, the head clothed with bright tawny hairs, the occipital bristles black. First and second segments of antennæ ferruginous, third piceous; thorax with slight brassy tinge, bristles black; abdomen purple, shining, with black vestiture, ferruginous at tip; legs bright tawny, clothed with tawny hairs, coxæ and trochanters black, wings dark brown, with a slight purple lustre, the disks of the areolets paler.

Walker's specimen was from Sierra Leone (*Rev. D. F. Morgan*).

Proagonistes præceps (Walker).

Laphria præceps, Walker, List Dipt. Brit. Mus., vii., p. 542, 1855.
Proagonistes validus, Loew. Öfvers af K. Vet.-Akad. Förhandl., xiv., p. 367, 1858; Abhandl. des Naturwissensch. Ver. für Sachsen u. Thüringen in Halle, ii. ('Die Dipteren-Fauna Südafrika's'), p. 170, (242), Tab. ii., fig. 6 *a* and *b*, 1860.

Length 29 mm. Thorax, abdomen, wings, coxæ, coxal hairs, and femora, except tips, black. Mystax, tibiæ, tarsi, and apices of femora rufous. Ovipositor short, dark brown.

Walker's specimen was from Port Natal (*R. W. Plant*). Loew's type was from Caffraria (*Wahlberg*). I have examined one specimen, compared with Walker's type, and loaned by the British Museum, which bears the data, "Pres. by Govt. Mus. Natal, 1911–45. H. C. Barnup, Tongaat, '08–9."

Proagonistes saliodes, sp. n.

Total length 44–46 mm. A huge powerful species, deep black, the mystax of a deeper red than that of most other species of the genus, the legs deep rufous with the base of the hind femur black. The coxal hairs are black, as is also the beard, though in the latter some hairs and bases of others are deep red.

Female.—Head black, first two antennal segments (third segment missing in case of type and paratype), facial prominence, ventral bulb of proboscis, mystax, some of the hairs and bases of others in the beard deep red. Thorax, abdomen, and coxæ deep velvety black, with concolorous hairs and bristles. Wings deep black, with a purplish lustre. Some of the cells with light areas in the middle. Ovipositor small, dark brown, with pale hairs. Legs long, but much stronger than in most species of this genus, and deep ferruginous, except hind femur, which in the holotype, though not in the paratype, has the basal three-fourths on the upper side and the basal half on the lower side black, with black hairs and bristles. There are black hairs also on the other femora.

Holotype, female, Nyasaland, Mt. Mlanie, 28. xi. 1913 (*Dr. S. A. Neave*), preying on a specimen of the wasp, *Belonogaster dubius*, Kohl. Paratype, female, Nyasaland, Ruo District, Muona, 6. xi. 1912 (*Dr. J. E. S. Old*). In British Museum (Natural History).

Proagonistes austeni, sp. n.

Total length 27–30 mm. A black species with head (except eyes and proboscis), pronotum, anterior and lateral portions of mesonotum, a broad line on pleura, tibiæ, tarsi, and first two pairs of femora reddish yellow.

Male.—Head yellowish red, except eyes, ocelli, and proboscis, which are black, and third joint of antenna, which is brownish red. Vestiture of beard yellowish red. Pronotum reddish yellow, with concolorous bristles. Mesonotum with a black median area extending to posterior margin; sides and anterior portions reddish yellow. Scutellum black, with deep red marginal bristles. Pleura black with a broad golden-red band, extending from a point in front of base of wing to mesocoxa. First two pairs of coxæ with whitish pile. Tibiæ, tarsi, and first two pairs of femora reddish yellow. Posterior femora reddish yellow, with inner dorsal aspect blackish. Wings dark brown. Abdomen black, genitalia reddish, with concolorous hair. Sixth segment with reddish hair. Hair on abdomen elsewhere black.

Female similar; ovipositor dark brown, and inner aspect of hind tibia with a brownish streak.

Holotype, male, Nyasaland, S.-W. of Lake Chilwa, 11.i. 1914 (*Dr. S. A. Neave*). Allotype, female, same data. Paratopotype, male, same data. In British Museum (Natural History): presented by the Imperial Institute of Entomology.

Proagonistes prædo, Austen.

Proagonistes prædo, Austen, Trans. Zool. Soc. London, xix., p. 87, pl. iii., fig. 2, 1909.

Total length 25–30 mm. I here quote Austen's synopsis from the original description:—

"Black; dorsum of thorax in type chiefly dull, scutellum and dorsum of abdomen moderately shining and purplish-black; dorsum of thorax with a ferruginous stripe along each side, including humeral callus and extending beyond suture; wings dark brown with a purplish tinge, central portion of second, third, fourth, and fifth posterior cells, and of axillary cell, and upper margin of second basal cell paler; upper surface of front and middle femora and distal third (below not more than distal fourth) of hind femora black, under side of front and middle femora and proximal two-thirds or three-fourths of hind femora burnt-sienna coloured; tibiæ orange-rufous, tarsi, especially front pair, somewhat darker, hind tibiæ with a dark brown spot above at extreme tips, last three joints of front and middle tarsi each with a small black spot below."

The type-specimen was taken in the Mubuku Valley, E. Ruwenzori, 6000–7000 feet, 5. ii. 1906. Two specimens, a ♂ and ♀ from the British Museum, compared with the type, bear the data: ♂, Uganda Protectorate, Mpanga Forest, Toro, 4800 feet, 13–23. xi. 1911 (*S. A. Neave*).

Proagonistes athletes, Speiser. (Figs. 1 & 2.)

Proagonistes athletes, Speiser, Zeitschr. für Hym. u. Dipt., vii. Jahrg., pp. 354, 356, 1907.

Total length 28–44 mm. A large species related to *P. rufibarbis*, from which it differs in having the hind femur mostly black, and, in the female, in having the eighth segment black instead of ferruginous.

Speiser recorded one male and one female from Dar-es-Salaam, one male from Usambara, June 1903, and one female with no more precise indication of origin than "German East Africa" (now Tanganyika Territory).

In the collection before me, from the British Museum, are 14 specimens from Nyasaland, Mt. Mlanje, collected by *Dr. S. A. Neave* on the following dates:— ♀, 21.xi. 1912, preying on a Cicada (*Koma bombifrons*, Karsch); ♂, 12. xii. 1912, preying on another Asilid (*Promachus abdominalis*, Ric.); ♂, 20. xii. 1912, preying on a Hymenopteron (*Belonogaster griseus*, Fabr.); ♂, 26. xii. 1912, preying on a Bombyliid (*Lomatia neavei*, Bezzi); ♂, 16. i. 1913, preying on a dragonfly (*Tramea basilaris*, Pal. de Beauv.); ♂, 4. xi. 1913; ♂, 17.xi. 1913, preying on a Cicada (*Koma bombifrons*, Karsch); ♀, 3. i. 1914; ♀, 6. i. 1914; ♂, 20. i. 1914; ♀, 20. i. 1914, preying on a Hymenopteron (*Belonogaster griseus*, Fabr.); ♂, 23. i. 1914; ♀, 30. i. 1914; ♀, 30. i. 1914. There is also a damaged ♀ from Portuguese East Africa, Gaza Land, Chirinda Forest (*David Odendaal*).

Proagonistes neavei, sp. n.

Total length 23–31 mm. Related to the foregoing species, but smaller and slenderer, with the beard lighter and almost straw-coloured, the middle tibia with the basal half black, and the mystax more scanty, and, in the male, with a few black bristles in the upper portion.

Male.—Head black. Antennæ (third segment missing in the case of all specimens before me), facial prominence and bulb of proboscis reddish yellow. Occipital hairs and bristles black. Palpi piceous, with red and black bristles intermingled. Mystax sparse, reddish, with a few black bristles in its upper portion where they are longest, projecting straight forward for three-fourths of their length, then curving abruptly downward. Beard pale yellow. Thorax black, with black hairs and bristles. Pleura and mesonotum with an indistinct brownish bloom. Wings dark brown, with a purplish sheen and with lighter median areas in some of the cells. Halteres yellow. Legs yellow; hind femora black except apex and outer fourth, which are reddish; middle femora black, with upper distal half reddish; front femur dark reddish, with black base and black hairs. Abdomen deep purplish black, with black hairs. Genitalia reddish, with concolorous hairs.

Female.—Similar, but with black hairs in mystax fewer. Ovipositor reddish at base and blackish at tip, where there is a crown of fine yellow hairs.

Holotype, male, Uganda Protectorate, Unyoro, Budongo Forest, 3400 feet, 11–15. xii. 1911 (*Dr. S. A. Neave*). Allotype, female, same data. Paratopotypes, 4 ♂♂, 1 ♀, same data. In British Museum (Natural History); presented by the Imperial Institute of Entomology.

EXPLANATION OF PLATE XI.

Proagonistes gigantipes, Bromley, sp. n. Nat. size.

XXVI.—*The Occurrence of* Pseudocerastes *in Sinai.*

By Major STANLEY S. FLOWER, O.B.E., F.L.S., F.Z.S.

Dr. K. P. SCHMIDT, Field Mus. Pub. Chicago, 273, Zool. 17, no. 6, pp. 223–230, May 1930, has described and figured *Pseudocerastes fieldi*, sp. n., from Transjordania, thus extending the range of the genus far to the west, as it had only been recorded from Persia, Baluchistan, and Waziristan.

Actually *Pseudocerastes* extends even further west to Sinai. Dr. Schmidt's interesting and valuable paper suggests to me to publish this fact, which I have not done before, hoping from year to year to have a specimen to compare with the Persian materal in the British Museum.

About sunset, 15 October, 1918, at "White Ridges" in Central Sinai, nine miles south of Hassana and about twenty-nine miles north of Nekhl, at between 1000 and 1100 feet above sea-level, I caught a small horned viper—a *Pseudocerastes*, of which the following notes were made:—

Length, snout to vent, 165 mm. or 6½ inches.
" tail 29 mm. or 1⅛ inches.
" total 194 mm. or 7⅝ inches.

Scales, number across top of head between eyes	c. 14
" " round eye	c. 16
" " of rows round mid-body	22
" " " body at last ventral ..	17
" " of ventrals	135
" " of anals	1
" " of subcaudals	39

Labials; upper 11 right and 13 left, lower 4 on each side in contact with the chin-shields.

Being on military service at the time, I was able only to preserve the specimen in spirit and forward it to Egypt, to the Giza Zoological Museum, where it eventually received the number 7152 and was labelled to be sent for identification to the British Museum. When I wrote "On Additions to the Snake Fauna of Egypt," P. Z. S. 1923, pp. 1079–1083, the specimen was not available for study. It was still in the Giza Museum in March 1924. Subsequent requests to have it sent to the British Museum have not met with success.

XXVII.—*A new Subspecies of* Acanthomyops (*Hymenoptera,* Formicidæ) from Kashmir. By HORACE DONISTHORPE, F.Z.S., F.E.S., etc.

THE ants of the genus *Acanthomyops* belong to the purely north temperate fauna, being common to the Palæarctic and Nearctic Regions, and species have been found in the Baltic Amber. Over twenty species and many subspecies and varieties have been described. The subspecies described below is closely related to the European *Acanthomyops bicornis,* Förster.

Acanthomyops (*Chthonolasius*) *bicornis*, Först., subsp. *kashmirensis*, subsp. n.

♀. Brownish yellow, front of head, antennæ, and legs paler, teeth of mandibles and eyes black; very finely punctured, covered all over with fine, short, silky pubescence.

Head broader than thorax, slightly emarginate posteriorly; *clypeus* somewhat arched; *frontal area* distinct, though not sharply defined; *frontal furrow* fine, reaching from base of frontal area to median ocellus; *mandibles* punctured, furnished with six sharp teeth, the terminal tooth twice as long as the rest; *maxillary* and *labial palpi* short, the joints getting shorter and narrower to apex; *eyes* large, bare; *scapes* of antennæ slightly curved and thickened towards apex, reaching beyond base of head by ⅓ of their length, without outstanding hairs, all the joints of the *funiculus* longer than broad, last joint a little longer than the two preceding taken together.

Thorax flat above; the *epinotum* somewhat rounded above the declivity, which is flat. *Scale* high, erect, both compressed and tapering towards apex, which is deeply emarginate forming two sharp points or teeth. *Wings* somewhat dusky, the *pterostigma* and *veins* brownish yellow. *Tibiæ* without outstanding hairs.

Gaster not voluminous, furnished with rows of bristles at the base of the segments beneath.

Long. 6 mm.

This insect is closely allied to *A.* (*C.*) *bicornis napolitana*, Emery, of the scale of the type of which Prof. C. Menozzi has kindly sent me a sketch. In *kashmirensis* the scale has slightly sharper points, the sides are a little less straight, and the base slightly less broad.

♂. Brown, head and scale darker; apex of mandibles, funiculus, and legs dirty yellow; very finely punctured, covered with fine, short, silky pubescence, which is sparser than in the ♀.

Frontal furrow distinct, reaching from base of frontal area to median ocellus; *eyes* large, without outstanding hairs; *mandibles* furnished with four small teeth and one long one at apex; *scape* with very short decumbent hairs; *wings* as in the ♀. *Scale* high, erect, deeply emarginate at apex forming two sharp points, or teeth, which are more pointed than in the ♀, fringed with short fine bristles. *Tibiæ* without outstanding hairs. *Gaster* furnished with bristles above and beneath.

Long. 4 mm.

Holotype and allotype in the British Museum Collection.

Described from a ♂ and ♀ taken by Mr. F. J. Mitchell in Kashmir, in 1923.

XXVIII.—*A new Ray of the Genus* Rhinobatus *from the Gold Coast.* By J. R. Norman.

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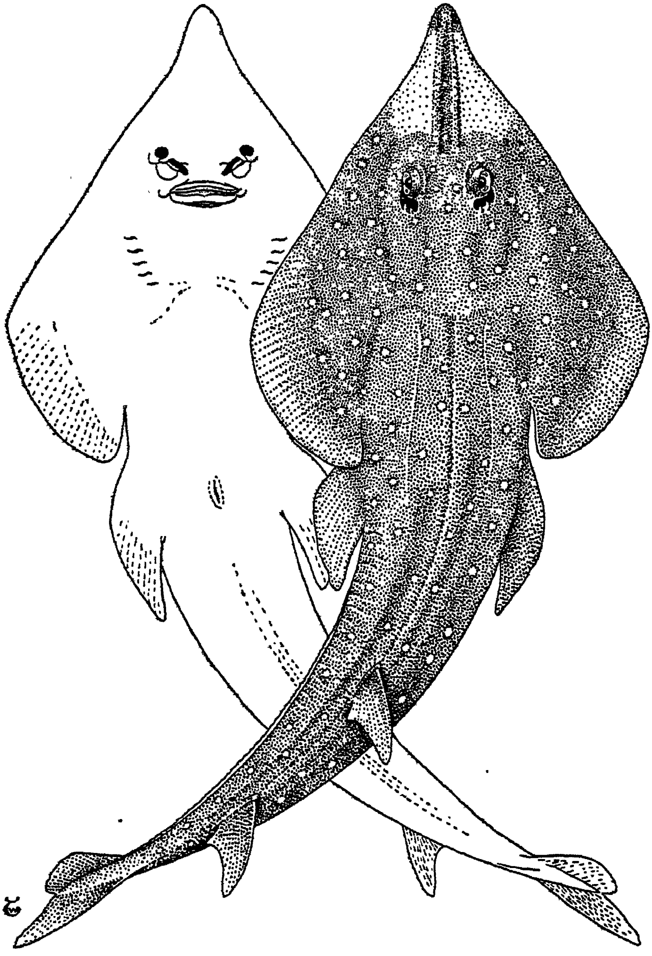
Rhinobatus albomaculatus, sp. n.

Snout moderate, bluntly pointed, the margins a little concave; its præorbital length 2¾ times the distance between the spiracles, and its præoral length 2⅗ times width of mouth. Rostral ridges rather narrow, separated throughout their length, converging anteriorly, nearly parallel posteriorly. Diameter of eye 5 in præorbital length of snout, that of eye + spiracle less than distance between spiracles. Both folds of spiracle well developed, the outer the more prominent. Nostrils of moderate length, oblique, 1⅔ in width of mouth, about 1¼ times that of internarial space; anterior valve extending inwards a little beyond level of inner edge of nostril. Mouth nearly straight. First dorsal a little more than twice as high as long; origin a distance behind base of pelvics a little greater than that between the two dorsals; base 3 in distance between dorsals. Skin covered with minute denticles, smooth to the touch; a series of very small, blunt, flattened spines in the median line of the back (not visible without a lens) and some smaller ones round the orbits and above the spiracles; no spines or enlarged tubercles on the shoulders. Upper surface greyish, with a number of small bluish-white spots surrounded by blackish, which are more or less regularly arranged.



Rhinobatus albomaculatus. Holotype (× about $\frac{1}{4}$).

Described from a single female specimen, 560 mm. in total length, from Accra, Gold Coast: presented to the British Museum by Mr. F. R. Irvine.

Four species of *Rhinobatus* have now been recorded from the West Coast of Africa *, which may be distinguished as follows:—

I. Anterior nasal valve not or scarcely extending inwards on to internarial space; præoral length of snout about 3 times width of mouth.
  A. Two spines on each shoulder arranged thus . . ; a row of spines on each rostral ridge .... 1. *rasus*, Garman.
  B. Three spines on each shoulder arranged thus ·: ; no spines on rostral ridges .... 2. *congolensis*, Giltay.
II. Anterior nasal valve extending inwards beyond level of inner edge of nostril; præoral length of snout $2\frac{3}{5}$ to $2\frac{4}{5}$ times width of mouth.
  A. Præoral length of snout $2\frac{4}{5}$ times width of mouth; distance between two dorsals greater than that from origin of first to base of pelvics; median series of spines on back small, compressed; coloration uniform............................ 3. *rhinobatus* (Linn.).
  B. Præoral length of snout $2\frac{3}{5}$ times width of mouth; distance between two dorsals less than that from origin of first to base of pelvics; median series of spines reduced to very small, flattened tubercles; upper surface with a number of small bluish-white spots .... 4. *albomaculatus*, sp. n.

BIBLIOGRAPHICAL NOTICE.

The Fauna of British India, including Ceylon and Burma.—Cestoda. Vol. I. By T. Southwell, D.Sc., Ph.D., A.R.C.S., F.R.S.E. London: Taylor and Francis. May 1930.

In this work, when completed, all the species of tapeworms known to occur naturally in India, Ceylon and Burma, and many species recorded from hosts not indigenous to those countries, but imported there, are to be described. The book will therefore be of the highest importance to all who are concerned with Oriental helminthology. The present volume deals mainly with the contents of the old groups Cestodaria, Pseudophyllidea, Trypanorhyncha and Tetraphyllidea. The vast majority of the worms contained in these groups are parasites of fishes, and hence perhaps not so important for the general helminthologist as the forms still to be dealt with in the second volume.

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* Metzelaar ('Over Tropisch Atlantische Visschen,' 1919, p. 194) records *R. halavi* (Forsk.), *R. granulatus*, Cuv., and *R. undulatus*, Olfers, but these determinations may be incorrect.

This volume is, however, much more than a mere descriptive catalogue of Indian species. Its 40 pages of preliminary matter form quite a valuable general introduction to the study of the Cestoda. They include a survey of the history of the classification of these worms from the seventeenth century to the present time, a general account of their anatomy and some hints on methods which have been found useful by the author for collecting, preserving, and studying them.

In a work primarily intended as a systematic account of the group, it is natural that classification should take a prominent place. The author appears to be somewhat preoccupied with the question of the taxonomic value to be assigned to individual morphological features, such as the form of the scolex, and not unnaturally finds that "cestodologists have yet to agree whether a head is more important than a pore, a hook more reliable than a particular type of muscular system, or a paruterine organ more valuable than an asymmetrically placed ovary." The fact is, of course, that the relationships of a Cestode, like those of any other organism, can only be determined by a study of its morphology and development *as a whole*. Though a single feature may often provide a valuable clue, its relative taxonomic importance must necessarily vary from one order, family, or even genus to another.

Some zoologists may feel inclined to question the statement that "the utility of a good scheme of classification lies in the fact that it enables us broadly to classify our knowledge and identify species." In saying this, however, Dr. Southwell appears to be simply stating the Linnean rather than the evolutionary point of view. It is true that a purely artificial classification (such as are most "keys") can be extremely useful. But it would perhaps have been better to say that the goodness of a scheme of classification lies in the fact that it is not only useful for the identification of species, but also indicates the state of our knowledge as to their phylogenetic relationships. In any case Dr. Southwell does himself an injustice if he suggests that his own classification does not attempt to keep both these ends in view.

It is true that there have been some differences of opinion among specialists, particularly during the last five years or so, on certain minor points in the taxonomy of the Cestodes. But it seems rather overstating the case to say that "at the present time the greatest diversity of opinion exists regarding even the broad lines on which these worms should be systematically arranged." Dr.

Southwell reviews the more important of the schemes of classification that have been proposed, and if these be tabulated side by side it will be found quite remarkable how few changes of a revolutionary nature have ever been proposed in the "broad lines" of the system. For the most part, all that has happened is that some of the main groups have appeared, from time to time, under new names and with different rank, while retaining almost precisely the same contents as at their inception. Essentially most authors still retain four of the five main groups (originally called "families") enumerated by Carus in 1863.

Dr. Southwell states that after long and careful consideration he is now thoroughly convinced that it is undesirable to retain these four old groups in their present application, and proposes a new classification, differing only in minor points from one proposed by Pintner in 1928. But Pintner's classification differed from those of his predecessors chiefly in reducing what had been regarded as orders to the rank of families, and splitting up two of the old orders (Tetraphyllidea and Cyclophyllidea) into a larger number of families. Some of these families of Pintner are now raised again to "superfamilies" by Dr. Southwell, while three of them are combined to form a new "superfamily." The net result is that instead of the old order Pseudophyllidea (Bothriocephalidea of Poche, 1926) we have a superfamily Dibothriocephaloidea; for the order Trypanorhyncha (Tetrarhynchidea of Poche) we have a superfamily Tetrarhynchoidea; for the Tetraphyllidea three new superfamilies (Phyllobothrioidea, Lecanicephaloidea, and Proteocephaloidea); and for the Cyclophyllidea (part of the Tæniidea of Poche) the superfamily Tænioidea. It is again, therefore, chiefly the names of the old groups that have been changed, and not their connotation. "Plus ça change, plus c'est la même chose." It is a little difficult to see the advantage of "superfamilies" over orders, or in what way (except euphony) the names Cestodaria and Eucestoda (the latter a new term) for the two principal divisions are better than the Amphilinoinei and Tænioinei of Poche. The group-names used by the latter author had at least the merit of being consistently formed from the names of typical genera, so that no unnecessary strain should be thrown on the memory in connecting the name of a group with its contents.

In the more detailed descriptive portion of the volume, dealing with Indian genera and species, the author is on ground with which he has long been familiar. No one has enjoyed better opportunities for collecting and studying the parasites of Elasmobranch fishes than Dr. Southwell, who was for many years concerned with Indian marine zoology, as Director of Fisheries for Bengal, Bihar and Orissa, and as Scientific Adviser to the Ceylon Company of Pearl Fishers. During the years 1906 to 1919, among much other helminthological work, he devoted special attention to extending the researches on the Cestodes of Indian Elasmobranchs already begun by Shipley and Hornell. As a result, he has recently been able to publish very complete monographs of the old orders Tetraphyllidea and Trypanorhyncha. The material contained in these monographs has naturally been largely drawn upon in the present work, and the majority of the excellent illustrations are from these sources. It may safely be said that no more comprehensive account of these groups has yet been published, and the book will be indispensable as a work of reference to all who are interested in them.

The volume being one of the well-known series on the Fauna of British India, the general excellence of its production goes without saying. As an individual monograph it reflects great credit not only upon its author but upon the able Editor of the series, Lt.-Col. J. Stephenson, and is a worthy successor to the volumes formerly edited by the late Sir Arthur Shipley. It is fully and clearly illustrated, and typographical and other errors appear to be happily few and unimportant. There is a useful list of references to literature, a systematic index to the species described, and an alphabetical index. (The last, by the way, includes only the scientific names of the parasites, and, although intended to include synonyms, does not seem to be very complete in this respect.) The writer is informed by Col. Stephenson that a " host-list," covering the whole work, is to appear in the second volume. The descriptive part of the work is well supplied with keys to families, genera, and species. A map of the Indian Empire is included at the end of the book.

Altogether this is a most useful and valuable piece of work, and all helminthologists will look forward with keen interest to the appearance of Dr. Southwell's second volume. H. A. B.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

May 14th, 1930.—Prof. E. J. Garwood, M.A., Sc.D., F.R.S., President, in the Chair.

The following communication was read:—

'The Geology of North-Eastern British Somaliland.' By Charles Barrington Brown, M.C., M.A., A.R.S.M., F.G.S.

The Author recently accompanied the Anglo-Italian Boundary Commission in Somaliland, and this paper summarizes the geological results of four months' field work.

The area discussed is a belt of country along the 49th meridian east, from the coast to about 80 miles inland.

There are three structural units:—(1) The sunken block or belt of the Aden Gulf: this is partly submerged and partly land which forms the low-lying coastal belt. It is bordered on the south by an important fault of 6000 feet throw, from the next unit (2) the faulted upraised mass of the Al Hills, which reach to over 7000 feet, and continue as a bordering scarp along the south of the Gulf as the Aroru and Afaf Hills; on the south succeeds (3) the inland plateau-region at 2000 to 3500 feet elevation. This plateau is entirely unfaulted, but has been subjected to folding of a peculiar kind, resulting in gently undulating areas, unaffected areas, and numbers of small synclinal basins the origin of which is obscure. Possible causes, as deposition of sediments on an uneven floor, collapse along short lines or points by removal of supports, and simple folding, are discussed. The longer axis, generally less than a mile in length, has in most cases a north-west to south-east orientation.

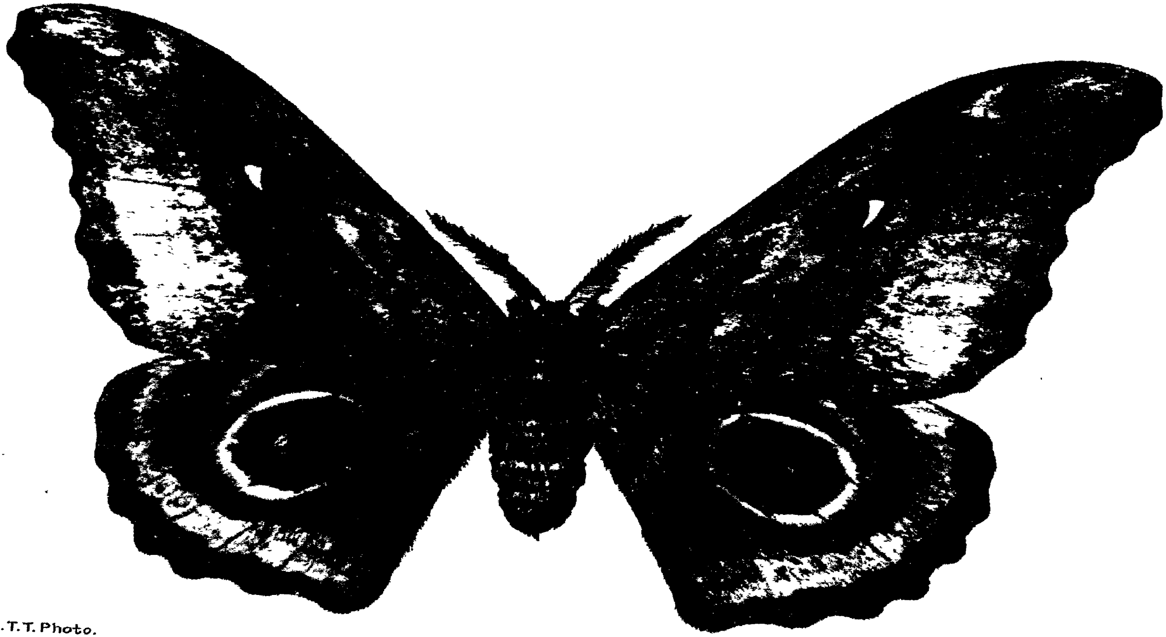
Rocks of several systems occur:—(1) the oldest, the Inda Ad Slates described by Farquharson, may be of Palæozoic age, but no fossils were found: a large boss of granite is reported; (2) Jurassic: 1850 feet of limestones and sandstones resting on the Inda Ad Series, containing a rich fauna at one horizon of Bathonian-Bajocian age, and at another horizon *Belemnopsis tanganensis* of Kimmeridgian age; (3) Cretaceous limestones 1450 feet thick, yielding Holcodiscid ammonites of Barremian age, and higher up, *Orbitolina, Ostrea (Lopha) dichotoma* Bayle, and *Exogyra overwegi* L. von Buch, indicating a Senonian age; (4) Middle and Lower Eocene: 2600 feet of limestones with an anhydrite-bed and some thin clays; sandstone is entirely absent. There are many fossils throughout, but they are especially numerous in the Middle Eocene above the anhydrite; echinoids and nummulites are the predominant types; (5) Upper Tertiary: *Ostrea (Lopha) folium* Linné and *Chlamys (Æquipecten) pallium* Linné, ranging from the Miocene, were found with a Middle Eocene fauna on the coast. North of the Rift Fault are coloured sands which may be referable to the Pliocene.

The Jurassic and Cretaceous rocks crop out on the face of the Al scarp fronting seawards. The Lower Eocene forms all the surface of the Al Hills, a splintered block tilted to the south. The Middle Eocene covers all the inland plateau.

There is a group of faults in échelon in the mountainous country, each with a throw of *nil* to 2000 feet in a short distance. The Aden Rift Fault was traced for a distance of 48 miles. Photographs taken in the course of the aërial survey concurrently with the marking of the Boundary show the faulting and the synclinal basins clearly.

TAMS

Ann. & Mag. Nat. Hist. S. 10. Vol. VI. Pl. VI.



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GYNANISA MAIA . DAULA, TAMS, RHODESIA.

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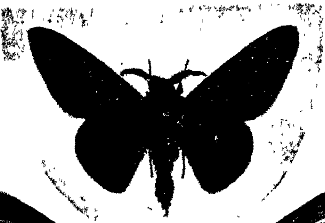

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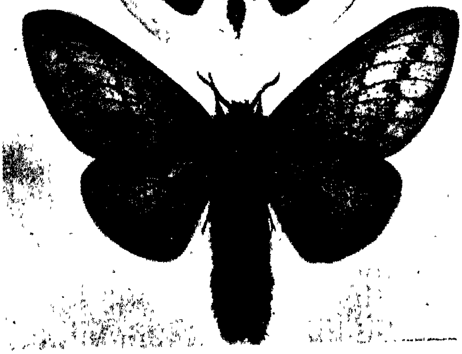

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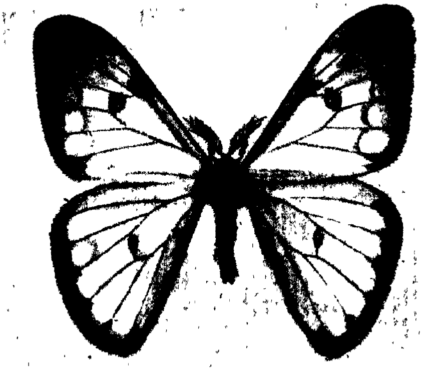

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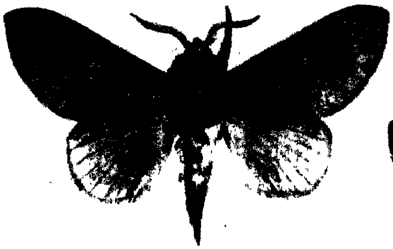

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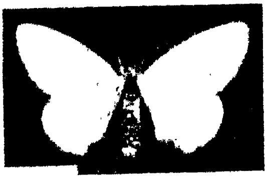

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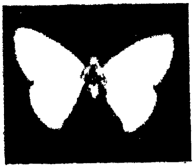

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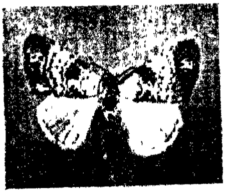

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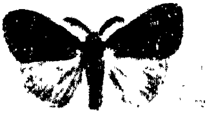

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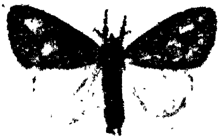

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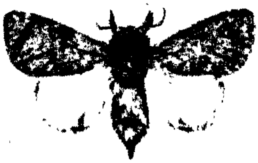

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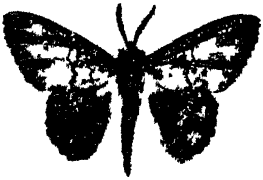
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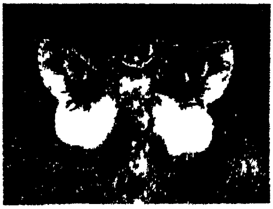
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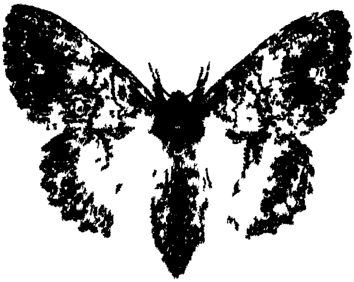
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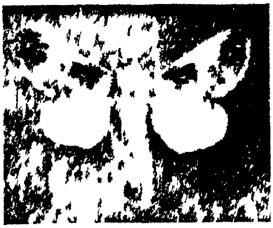
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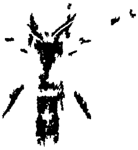
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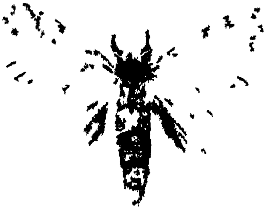
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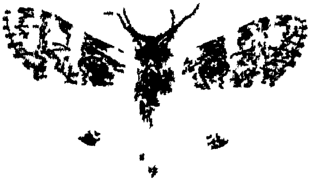
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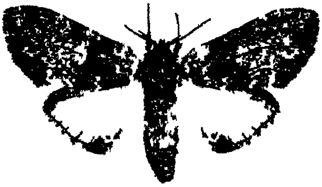
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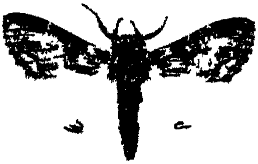
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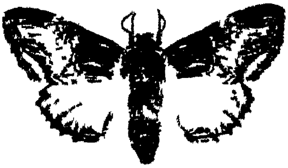
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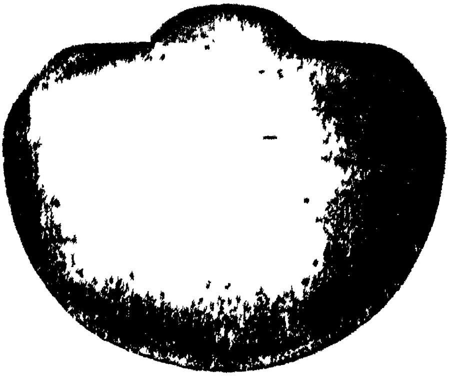

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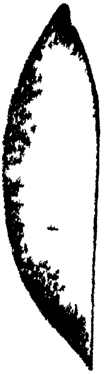

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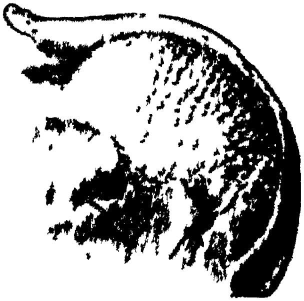

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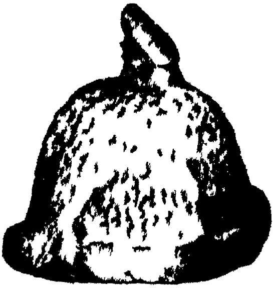

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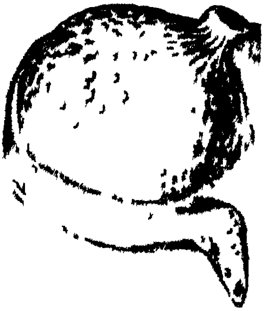

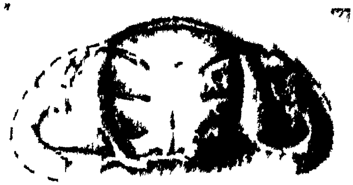

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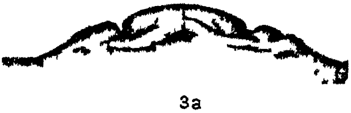

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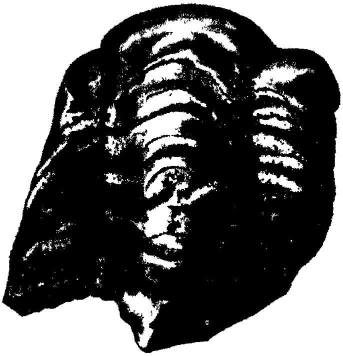

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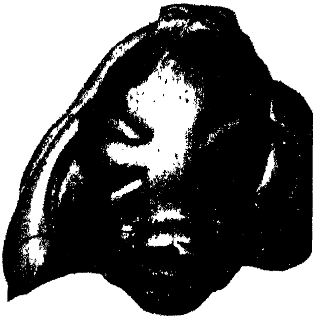

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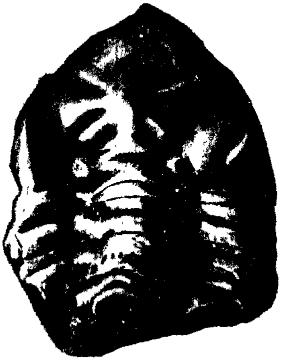

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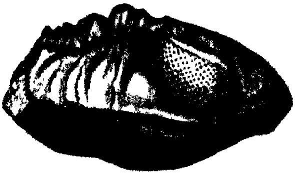

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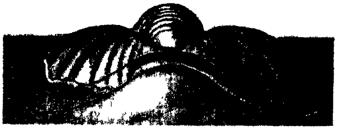

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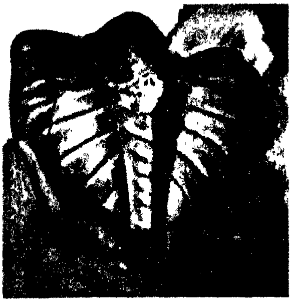

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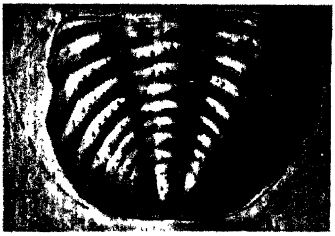

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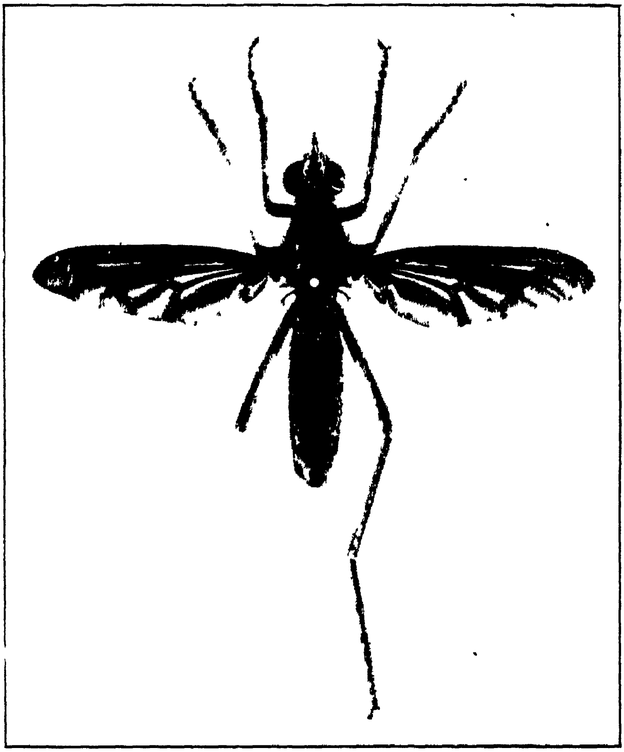

Proagonistes gigantipes, Bromley, sp. n. Nat. size.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 33. SEPTEMBER 1930.

XXIX.—*On British Fossils named by William Smith* [*].

By L. R. Cox, M.A.

(Published by permission of the Trustees of the British Museum.)

[Plate XII.]

INTRODUCTION.

Although the name of William Smith [†], the founder of the science of Stratigraphical Palæontology, is a household word among geologists, one aspect of his work has hitherto passed almost unrecognized. Except in two or three instances, palæontologists have overlooked the fact that several important invertebrate species were named for the first time in one or other of his two treatises, 'Strata identified by Organized Fossils' (London, 1816–19) and 'Stratigraphical System of Organized Fossils' (London, 1817). In most cases, even when no figures are cited, Smith's descriptions are clear enough to indicate the identity of his species to workers familiar with British fossils, and it is indeed surprising that scarcely any of his names receive mention even in our standard monographs. The reason may lie partly in the small circulation of Smith's works, and partly in the fact that description of species was incidental to their main purpose, so that, as descriptive works, they were quite overshadowed by Sowerby's 'Mineral Conchology,' which was then in course of publication.

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[*] A preliminary draft of this paper was entitled "On the Name of the Kimmeridge Clay Oyster," and as such has been cited by Dr. W. J. Arkell in the bibliography of his "Monograph of British Corallian Lamellibranchia" (Palæont. Soc. 1929), p. 25.

[†] For an account of William Smith's life and work, see J. Phillips, 'Memoirs of William Smith' (London, 1844), and T. Sheppard, "William Smith: his Maps and Memoirs," Proc. Yorks. Geol. Soc. vol. xix. 1917, pp. 75-253. The latter work contains a full bibliography of literature relating to the "Father of English Geology."

It must be mentioned that Sowerby was associated with Smith in the production of the 'Strata identified,' and was responsible for drawing the plates and arranging for its publication. This work concerns us less than the other one, although it has not previously been pointed out that certain names, which originated with Sowerby, were here published validly for the first time. Sowerby does not seem to have had any hand in the production of the 'Stratigraphical System,' and it is in that work that Smith takes the initiative and names certain species which, at the time of publication, had not been described in the 'Mineral Conchology'; the latter, however, is cited by Smith wherever possible. The subsequent adoption of Smith's names has depended entirely on Sowerby's attitude towards them. Thus the names *Avicula echinata* and *A. costata* were adopted by Sowerby and have come into general use. Others, such as *Modiola anatina*, were rejected by Sowerby, who described Smith's species under other names; the result has been that Smith's names have been quite overlooked. Since Smith's types are in most cases extant, and his descriptions recognizable, the validity and priority of his names must undoubtedly be acknowledged. It is the object of this paper to record the results of examination of Smith's collection and to discuss the effect upon nomenclature of the adoption of his specific names.

William Smith's Collection.

William Smith's collection was acquired by the British Museum in 1816 and 1818. His nephew and biographer, J. Phillips (1844, 'Memoirs of William Smith,' p. 78), tells us how heavy financial losses, connected with the exploitation of a property near Bath, purchased for stone-quarrying, reduced Smith to the necessity of parting with his fossils:

"As a means of reducing his difficulties he proposed to sell that geological collection which had been so much prized, and through the assistance of some friends a communication was opened with the Treasury. Two gentlemen being deputed to examine the collection, reported favourably, and their Lordships were pleased to authorise the purchase, in order that the specimens might be fitted up in the British Museum. There was also some defined notion of engaging Mr. Smith's services at the Museum to take charge of and explain the geological principles which this collection was intended to illustrate; but this project came to nothing. The sum of money granted for the purchase was £500 (January 1816). By a later order the further sum of £100 was allowed for an additional series obtained from North Wilts, Essex, and other localities, to complete the series (February 1818); and £100 was granted to compensate for the trouble of arrangement, making catalogues, &c. The whole sum was £700; the number of species supposed to be 693, and of specimens 2657. The authorities at the Museum assigned first one and then another apartment to the collection, and it was arranged according to the peculiar views of the framer; but the Museum then possessed no department of 'palæontology' or 'geology,' and there was a difficulty in making these specimens, which were arranged on sloping shelves, to represent the strata, a part of the series of objects open to the public. The present state of this 'the first stratigraphical collection' ever made is unknown."

Apparently little attention was paid to Smith's collection until after the removal of the natural history collections of the British Museum to South Kensington, which began in 1880. It seems to have been removed from exhibition soon after its acquisition and probably relegated to drawers; I can find no reference to it in any of the British Museum guide-books published prior to the opening of the new museum. In 1885–86, however, when the palæontological exhibits were being arranged in the new galleries, under the direction of Dr. H. Woodward, the interest of Smith's collection was appreciated and it was accorded the place of honour in Gallery XI., which contains several other collections of especial historical interest. Most of the specimens were registered and relabelled by R. Etheridge (jun.), a representative series placed on exhibition, and the remainder arranged stratigraphically in the drawers underneath. There the collection has remained undisturbed up to the present day. Unfortunately, although Smith's material had not been dispersed among the general Museum collection, a number of specimens had disappeared by the time its interest was realized—whether they had been disposed of as "duplicates" it is impossible to say. At the present day about 2000 (including 275 rock-specimens) remain out of the original 2657.

It is obvious from an inspection of Smith's collection that he took great care to make it as "fool-proof" as possible, so that, even after 114 years, there can be no doubt as to the authenticity of the information with every specimen. The larger fossils have their localities written on them in Indian ink, and most of the specimens bear a reference-mark, usually consisting of a combination of a Roman capital, a number, and a small letter. The meaning of these is explained in the Introduction to his 'Stratigraphical System,' which consists of a detailed catalogue of the specimens deposited in the Museum. "On the specimens, Roman capitals mark the genus,—the figures, 1, 2, 3, &c., refer to the species,—and the small letters, *a*, *b*, *c*, &c., to the localities or sites in the Strata." The specimens of each genus are numbered in the same order as in the book, so that the correctness of the information with each specimen can at once be checked by reference to the book. MS. lists of the collection, giving the reference-mark of each specimen, were deposited by Smith in the Museum; one of these lists, referring to the part of the collection acquired in 1818, can still be consulted. Prior to their re-labelling by Etheridge, all the specimens seem to have been pinned on to wooden tablets, a few of which still remain. It is impossible to say at what period they were placed on the tablets, but these are undoubtedly very old. Every tablet that remains bears the locality of its specimen and a reference to where the latter is mentioned in the book. The information on each tablet discarded by Etheridge was carefully copied by him on to a label when the collection passed through his hands.

With all the specimens so carefully marked, the identification of the originals of Smith's new species has been an easy matter, even when no figures were given; especially as in most cases I was able to recognise the species from the description alone, before consulting the collection. When, as in the 'Strata identified,' new names were given to specimens figured, but no descriptions were published, the figured specimens must be considered as the holotypes of their respective species. In the case of the 'Stratigraphical System,' however, where descriptions were published, all the specimens originally referred to one of the species described as new must be regarded as syntypes, and the species fixed by selection of a lectotype. This is all the more necessary, since usually each species was recorded from two or three different localities at the same horizon, and sometimes from different horizons also; hence Smith may have grouped together, as one species, two or three forms which are now regarded as distinct. No plates were published in the 'Stratigraphical System,' but in some cases reference was made to a figure in the 'Strata identified.' Usually the figured specimen is the most appropriate one to choose as lectotype, since the species could have been identified at any time by reference to the figure. This consideration holds good even when the specimen in question is no longer available, provided that the figure suffices for the determination of the species; there is always a possibility that a lost figured specimen may one day be recovered. When no specimen was figured, as judicious a selection of a lectotype as is possible must be made from the material still available. No specimens at all remain of certain of Smith's new species. In such cases, it seems reasonable to adopt his trivial name if his description suffices for the determination of the species (e.g., *Trigonia curvirostra*), and to select a neotype for the species from other material.

NEW NAMES IN W. SMITH'S 'STRATA IDENTIFIED BY ORGANIZED FOSSILS.'

This work was published in four parts, dated as follows: Title-page, Introduction, pp. 1–8, 4 pls. ("Tooth of Mastodon," "London Clay," "Craig," "Upper Chalk"), June 1st, 1816;

pp. 9–16, 5 pls. ("Lower Chalk," "Green Sand" (2), "Brick-Earth," "Portland Stone"), Oct. 1st, 1816; pp. 17–24, 5 pls. ("Oak-Tree Clay," "Coral Rag and Pisolite" (2), "Clunch Clay and Shale," "Kelloways Stone"), Sept. 1st, 1817; pp. 25–32, 5 pls. ("Cornbrash," "Forest Marble," "Upper Oolite," "Clay over the Upper Oolite," "Fuller's Earth Rock"), 1819 (precise date unknown, but prior to Aug. 1st, since Sowerby alludes to this part, as having just been published, on the cover of the part of the 'Mineral Conchology' published on that date). It was not completed, and a "Marlstone" plate referred to in the 'Stratigraphical System' (p. 114) never appeared. According to J. Phillips (1844, 'Memoirs of William Smith,' p. 79), seven parts in all had originally been contemplated. The last part which appeared was published two years later than the 'Stratigraphical System,' and hence contains references to that work and figures of certain species there described. The following names were published validly for the first time in the work now under consideration.

Inoceramus cuvieri, J. Sowerby MS. W. Smith, 1816, Strata ident. p. 10, "Lower Chalk" pl. fig. 1.

The name *Inoceramus cuvierii* had previously appeared as a *nomen nudum* in 1814 (Ann. Philos. iv. p. 448), in the abstract of the proceedings at a Linnean Society meeting. Both generic and trivial names, however, were first published validly in Smith's work. His figured specimen, from Heytesbury, Wilts, must therefore be accepted as the holotype of *I. cuvieri*, and the species to which it belongs as the genotype of *Inoceramus*. This specimen (L. 1444), which is still preserved in his collection, is a fragment, about 100 mm. in length, of the postero-dorsal region of a right valve. The marginal part forms a very thick, projecting, convex rim, and is separated by a concave region from the rest of the valve, which is flat. The ligament-pits are rectangular, and increase in length in a posterior direction. There can be no doubt that this fragment belongs, not to the *I. cuvieri* of J. Sowerby's later work (1822, Trans. Linn. Soc. xiii. p. 453, pl. xxv.), but to J. de C. Sowerby's *I. involutus* (1828, Min. Conch. vi. p. 160, pl. dlxxxiii. figs. 1–3). It is true that Smith gave the horizon of his specimen as "Lower Chalk," while *I. involutus* comes from the *M. cortestudinarium* and *M. cor-anguinum* zones of the Upper Chalk. Mr. C. D. Sherborn, however, to whom I have shown Smith's specimen, is of the opinion that the adhering matrix belongs to the Upper Chalk; while Miss H. M. Muir-Wood has kindly examined a small *Terebratulina* contained in the matrix, and, after comparison with a considerable series of specimens, has identified it as *T. striata*, Wahl., informing me that in the details of its sculpture it can only be matched with specimens from the Senonian. Beds of that age certainly occur in the Heytesbury district (see

A. J. Jukes-Browne, 1904, "Upper Chalk of England," Mem. Geol. Surv. p. 72); hence it seems most probable that the horizon given by Smith is incorrect*. The name *I. cuvieri* must therefore be applied to the species hitherto known as *I. involutus*, which becomes the genotype of *Inoceramus*. Although Stoliczka made *I. involutus* the type of a distinct genus, *Volviceramus*, Woods (1912, Mon. Cret. Lamell. ii. p. 331) thinks that it is descended directly from *I. lamarckii*, Parkinson, with which he unites the *I. cuvieri* of J. Sowerby's later work. In a previous paper (1928, Quart. Journ. Geol. Soc. lxxxiv. p. 241) I selected *I. lamarckii* as genotype of *Inoceramus*. The change of genotype indicated in the present paper is therefore fortunately of no real consequence.

Cirrus depressus, J. Sowerby MS. W. Smith, 1816, Strata ident. p. 10, "Lower Chalk" pl. fig. 5.

The figure in Smith's work represents the specimen as viewed from above its apex, and hence does not show the height of the spire. This specimen (G. 1573, Pl. XII. fig. 1), from the Lower Chalk of Warminster, is still preserved in his collection, and must be accepted as the holotype of *C. depressus*. It does not belong to the very depressed form which Mantell (1822, Foss. S. Downs, p. 195, pl. xviii. figs. 18, 22) and Sowerby (1823, Min. Conch. v. p. 35, pl. ccccxxviii. fig. 3) later described under the same name, the spire angle being about the same as in Mantell's *C. perspectivus* (1822, *op. cit.* p. 194, pl. xviii. figs. 12, 21). D'Orbigny (1843, Pal. Franç. Terr. Crét. ii. p. 255) and Woods (1896, Quart. Journ. Geol. Soc. lii. p. 86) regard *C. depressus*, Mantell, and *C. perspectivus* as synonymous, and adopt the latter name. *C. depressus*, which is here shown to be the prior name for the more elevated form, must replace the name *C. perspectivus* for the species, while another name must be found for the more depressed form, if it is desired to distinguish it as a definite variety. The species, of course, belongs to the genus *Pleurotomaria*.

It must also be noted that the generic name *Cirrus* was published by W. Smith on exactly the same day (Oct. 1st, 1816) as that on which it was first published by Sowerby (Min. Conch. ii. p. 93). The genotype has been fixed by Cossmann (1916, Ess. Pal. Comp. x. p. 199) as *C. nodosus*, from the Inferior Oolite, one of Sowerby's original species (*loc. cit.* pl. cxli. fig. 2). This species is distinct from, although congeneric with, the *C. nodosus* of Sowerby's later volume (1818, *op. cit.* iii. p. 35, pl. ccxix. figs. 2, 4), to which the specific name is usually applied.

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* Further confirmation of this conclusion is given by an *Inoceramus* fragment recently collected by Professor A. Morley Davies, and kindly presented by him to the British Museum (L. 54280). This specimen is remarkably similar to Smith's holotype, agreeing with it in almost every detail. It came from the *M. cor-anguinum*-Zone of a pit near Witherage Woods, E. of Penn, Bucks.

Terebratula pectinata, W. Smith, 1816, Strata ident. p. 12, 2nd "Green Sand" pl. fig. 4.

This name, which also appears on p. 32 of the Strat. Syst., is a synonym of J. Sowerby's *T. pectita* (1816, Min. Conch. ii. p. 83, pl. cxxxviii. fig. 1). The species is referred to as *T. pectinata* on the cover of the part of the Min. Conch. in which Sowerby's description was published.

Ostrea delta, W. Smith, 1817, Strata ident. p. 18, "Oak-Tree Clay" pl. fig. 6.

The well-known oyster of our Kimmeridge Clay is usually known as "*Ostrea deltoidea*, J. Sowerby," but reference to Sowerby's description (1816, Min. Conch. ii. p. 111, pl. cxlviii.) will show that the species is not there described as new, but is referred to the Lamarckian *O. deltoidea*, first described in 1806 (Ann. Mus. Hist. Nat. Paris, viii. p. 160). This determination of Sowerby's was erroneous, since Lamarck's species is a Chalk oyster synonymous with his *O. vesicularis*, described at the same time. Bronn (1836, Leth. Geogn. i. p. 316) sought to rectify Sowerby's mistake by naming the Kimmeridge species *O. sowerbyana*, while Bayle (1878, Explic. Carte Géol. France, iv. (Atlas), pl. cxxxi. fig. 1; pl. cxxxii. fig. 1) figured the same form under the name *Ostreum subdeltoideum*, attributed to Pellat. In 1825, however, J. de C. Sowerby (Min. Conch. v. p. 143, pl. cccclxxxviii. fig. 1) had described an *O. læviuscula*, said to come from the Lias, but undoubtedly from the Kimmeridge Clay, and the same species as J. Sowerby's *O. deltoidea.*

In the work of W. Smith's now under consideration, our Kimmeridge Clay form is cited as *O. delta*, both on the plate and in the text, and it seems very desirable to employ this name for the species, since it at once recalls the familiar, although invalid, name *O. deltoidea.* I find, however, that the name *O. delta* did not originate with W. Smith, as I at first supposed, but appeared on the back page of the blue cover of the part of the 'Mineral Conchology' in which Sowerby first described the species, although the latter was attributed to *O. deltoidea* in the text. This earlier appearance of the name *O. delta* might perhaps be regarded as a misprint, but Smith's publication of the name cannot be thus dismissed. Since Smith cites Sowerby's figure as well as figuring a specimen of his own, Sowerby's specimen (43357) may be selected as lectotype of *O. delta*.

Terebratula digona, J. Sowerby, var. *globosa.* W. Smith, 1819, Strata ident., "Cornbrash" pl. fig. 9.

This varietal name is ruled out by Link's *Terebratula globosa* (1807), and in any case could scarcely be accepted, since in the text (p. 26) the same figure is referred to as "*Terebratula digona* (var. *gibbosa, rotunda*)."

Madrepora porpites, W. Smith, 1819, Strata ident. p. 30, "Upper Oolite" pl. fig. 4.

It cannot be maintained that this specific name was a mistake for *M. porpita*, Linné (1767, Syst. Nat. edit. 12, p. 1272), since Smith does not cite Linné as its author, as he does in the case of *M. turbinata* and *M. flexuosa*, figured on the same plate. Strictly speaking, *M. porpites* is not a homonym of *M. porpita*, and the name is available for the form from the Great Oolite of Broadfield Farm figured by Smith. This specimen is no longer extant, but there can be no doubt as to its identity. As H. M. Edwards and J. Haime record (1851, Mon. Brit. Foss. Corals, p. 120), it is the species which Lamouroux later (1827, Expos. Méthod. Polyp. p. 86, pl. lxxxiii. figs. 1–3) described as *Fungia orbulites*, now referred to *Anabacia*. The Linnean *M. porpita* is identified by the same authors (1854, *op. cit.* p. 246) as a Silurian coral; it is the type of the genus *Palæocyclus*.

New Names in W. Smith's 'Stratigraphical System of Organized Fossils.'

The full title of this work is 'Stratigraphical System of Organized Fossils with reference to the Specimens of the Original Geological Collection in the British Museum: explaining their State of Preservation and their Use in identifying the British Strata.' It bears the date 1817, the month not being mentioned, and consists of Title and Contents pages, Introduction (pp. i–xi), 118 pages of text, an Appendix ("Observations on Echini") of three pages, a "Geological Table of British Organized Fossils," and a "Stratigraphical Table of Echini." On the Contents page is stated, "Part II., which completes the Work, will be speedily published." This second part, however, never appeared. The following are the new names in this work; they are cited in the order in which they first appear. To save space, the original paragraphing of the quoted diagnoses is not retained in every

Turritella trilineata, W. Smith, 1817, Strat. Syst. p. 8.

"Volutions flattish, lower part angular, sometimes projecting, with three smooth spiral threads and obscure spiral striæ: base with several spiral striæ. Length 1 to 2 inches, volutions about ten. The lower part of the volution angular, with a projecting edge and a small thread above it; upper part thinned, a slight thread beneath it: a projecting thread on the middle. Base rather convex.

"*a* Bramerton. *b* Trimingsby. Foxhole. Sutton. Playford." [Crag.]

There remain only two eroded specimens of this species, both from the Norwich Crag of Bramerton. It is undoubtedly synonymous with *T. incrassata*, J. Sowerby (1814, Min. Conch. i. p. 111, pl. li. fig. 6). Nevertheless, one would expect it to receive some mention in the monographs of Crag mollusca by S. V. Wood and F. W. Harmer, but it has been quite ignored by those authors. Its only mention subsequent to Smith's description seems to be in R. Taylor's list of Norwich Crag mollusca (1824, Trans. Geol. Soc. (2) i. p. 373).

Ammonites tuberculatus, W. Smith, 1817, Strat. Syst. pp. 16, 27, and reference to Strata ident., "Lower Chalk" pl. fig. 4.

"Involute, keeled; inner volutions half exposed, surface rough with large tubercular projections; tubercles oblong on the inner margin, furcating into two subnodose ridges; back wide, edged by large pointed knobs: keel entire.

"The ridges proceeding from the knobs on the inner margin are each elevated into a smaller tubercle on the middle of the volution, and then are either obscurely united into one knob on the back, or otherwise form separate knobs: aperture oblong, about two-fifths of the largest diameter, which is sometimes three inches.

"Norton." [Lower Chalk.]

"*a* Rundaway Hill. *b* Chute Farm." [Greensand.]

The Lower Chalk fossil from Norton, figured by Smith, is no longer in his collection, but is clearly a young specimen of *Ammonites varians*, J. Sowerby (Oct. 1st, 1817, Min. Conch. ii. p. 169, pl. clxxvi.), now referred to *Schlœnbachia.* This specimen may be regarded as lectotype. Since the precise date of publication of the Strat. Syst. is unknown, it is uncertain whether Smith's or Sowerby's was the prior name. It will, of course, be preferable to continue to use Sowerby's. Of the other specimens recorded by Smith as *A. tuberculatus*, there remain only three eroded and immature ammonites from the Upper Greensand of Chute; these belong to the genera *Schlœnbachia* and *Hypoplites*, but their precise determination is impossible. J. Sowerby's *A. tuberculatus* (1821, Min. Conch. iv. p. 4, pl. cccx. figs. 1–3) came from the Gault. Dr. L. F. Spath (1925, Mon. Ammon. Gault, i. p. 82) has separated the form represented by figs. 1 & 2 as a distinct species, *Euhoplites nitidus*; a new name will now have to be proposed for fig. 3 also.

Galea, W. Smith, 1817, Strat. Syst. p. 21; also Appendix ("Observations on Echini") and "Stratigraphical Table of Echini."

With the exception of *Clavicula*, discussed below, this is the only generic name published validly for the first time in the work now under consideration. It originated, however, with Klein in pre-Linnean times (1754, Ordre Nat. Oursins de Mer, p. 78), and was also published by Meuschen (1787, Mus. Gever. p. 486), who was not binomial. Smith's diagnosis, given in his Appendix, reads, "Ovate, with porous rays from the vertex to the mouth, near the broadest end of the base; vent at the narrow end of the base." Two Chalk species, *Echin[ocorytes] ovatus*, Leske, and *E. pustulosus*, Leske, were referred by him to *Galea*, and the former may now be selected as genolectotype. Both, however, are undoubtedly referable to *Echinocorys*, Leske, and are usually regarded as synonymous with *E. scutatus*, Leske. Hence *Galea* is a synonym of *Echinocorys*.

Clavicula cucumerina, W. Smith, 1817, Strat. Syst. pp. 23, 54.

"Long, of nearly equal thickness, granulated in quincuncial order.
"Surry" (*sic*). [Chalk.]
"Longleat Park. Derry Hill." [Coral Rag.]

The name *Clavicula cucumerina* originated in pre-Linnean times with Klein (1754, Ordre Nat. Oursins de Mer, p. 146). Parkinson (1811, Org. Rem. iii. pp. 45–46, pl. iv. figs. 2, 6, 8, 15–17) mentions "*Clavicula*" as a class of urchin-spines, and cites two "species," "*Glandaria*" and "*Cucumerinæ*" ("*Cucumerina*" in the explanation of his plate). I do not think that his use of these terms can be considered binomial. Smith, however, is certainly binomial, and it appears to me that *Clavicula* may be regarded as a "generic" name available for urchin-spines of this group, pending the discovery of the tests to which they belonged. The name *Aptychus* affords a comparable case, since it is in general use as a "generic" name for ammonite opercula, in the absence of definite information as to the parent ammonite genera. Article 27 of the International Rules of Zoological Nomenclature states that the oldest available trivial name must be retained when any part of an animal is named before the animal itself, and this rule obviously must apply when the spine of a sea-urchin is discovered and named before the actual test.

The Chalk specimen from Surrey referred to by Smith is still preserved in his collection (E. 473, Pl. XII. fig. 2), and is now designated as lectotype of *Clavicula cucumerina*. It consists of the proximal portion, about 38 mm. long, of an elongate, very gradually tapering spine, the maximum diameter of which is about 8·6 mm. Its surface is ornamented with about 30 longitudinal rows of small prickles, which increase by intercalcation towards the widest part of the spine. Between these rows the surface is finely shagreened. The species is undoubtedly the same as Mantell's *Cidaris sceptrifera* (1822, Foss. S. Downs, p. 194, pl. xvii. fig. 12), which was also founded on a single spine. The name *cucumerina* therefore replaces *sceptrifera*.

Pecten sexcostatus, W. Smith, 1817, Strat. Syst. p. 30 ("*sexcostata*").

"Subtriangular, oblong, front semicircular, margin toothed; convex valve ribbed, principal ribs six, five lesser ones between each; surface deeply hollowed between the principal ribs.
"Chute Farm." [Greensand.]

S. Woodward (1833, Geol. Norfolk, p. 48, pl. v. fig. 29) is always cited as author of the species *P. sexcostatus* (*cf.* Woods, 1903, Mon. Cret. Lamell. i. p. 214). Smith's description, however, is quite recognizable, while his holotype (L. 1472, Pl. XII.

fig. 3), a well-preserved specimen from Chute Farm, near Warminster, is preserved in his collection. It belongs to the species described by d'Orbigny as *P. cometa* (see Woods, *loc. cit.* p. 200, pl. xxxix. figs. 6–10), and is distinct from the *P. sexcostatus* of S. Woodward and later authors. The latter species will take d'Orbigny's name, *P. dutemplei* (1847, Pal. Franç. Terr. Crét. iii. p. 596). Woodward obviously adopted the name *P. sexcostatus* from Smith, since he remarks in a footnote, "The Norfolk specimens are identical with those from the green sand of Wiltshire."

Trigonia curvirostra, W. Smith, 1817, Strat. Syst. pp. 44, 51.

"Oblong, triangular, narrow towards the beak; anterior side depressed, bounded by a very sudden termination of the other more convex part of the shell; posterior side rounded from the beaks into an oblique straightish front; covered by small transverse furrows which are diminished in size on the anterior side; beaks much hooked from the anterior side. Length about an inch.

"North Wilts Canal." [Oak-Tree (Kimmeridge) Clay.]
"Longleat Park." [Coral Rag.]

Besides true representatives of the genus, Smith included in *Trigonia* a number of superficially similar, although quite unrelated, shells. It is also necessary to remember that the terms "anterior" and "posterior" were used by him in the opposite sense to that understood at the present day, while his term "transverse" refers to the direction of what we now call the length of the shell. If we bear these points in mind, it is obvious that his *T. curvirostra* is an *Opis*. Unfortunately, no representatives of this species remain in his collection. In a considerable amount of Kimmeridge Clay material examined, however, I have met with only one species of *Opis*, which is fairly abundant at some localities. There can be no doubt, therefore, that this is the Kimmeridge Clay species described by Smith, and it is to this form that the name *O. curvirostra* may now be restricted by the selection of a neotype (Pl. XII. fig. 6; British Museum, L. 53454, Kimmeridge Clay of Wootton Bassett, North Wilts). This specimen is slightly crushed, but shows the ornamentation well. An uncrushed, but rather more eroded specimen (24562), from the same locality, is also figured (Pl. XII. fig. 7). Fortunately, this species has escaped description in any work since Smith's, although Blake (Quart. Journ. Geol. Soc. xxxi. p. 220) referred it to *O. suprajurensis*, Contejean (1859, Kimm. Montbéliard, p. 258, pl. x. figs. 31–33), a species which is much smaller and relatively more elongate.

Although it is evident, from the fact that Smith's description of *T. curvirostra* was given in his chapter on Oak-Tree Clay fossils, that it was the Kimmeridge form that he had chiefly in mind, he also recorded the species from the Corallian. Hence he seems to have confused our Corallian species, *O. corallina*, Morris & Lycett, with the Kimmeridge one. The species in question is closely related, but has a more projecting marginal keel.

Astarte ovata, W. Smith, 1817, Strat. Syst. pp. 44, 51, 105, and reference to Strata ident., "Oak-Tree Clay" pl.

"Transversely oblong, depressed, anterior side lengthened; transversely striated; lunette elliptical; margin crenulated within; shell thick; beak acute, solid; a small pit beneath the posterior slope of the hinge.

"North Wilts Canal." [Oak-Tree (Kimmeridge) Clay.]

"South of Bayford. Well near Swindon, Wilts and Berks Canal. Cast of the inside. Shippon. Kennington. Cast of the inside." [Coral Rag.]

"*a* Between Sherborn and Yeovil. *b* Coal Canal. Cast of the inside. *c* Tucking Mill. Cast of the inside. *d* Bath. Cast of the inside. *e* Fulbrook. Cast of the inside. *f* Between Cross Hands and Petty France. Cast of the inside. Mitford Inn. Cast of the inside. Northwest of Northampton. A very small Cast of the inside." [Under Oolite.]

The diagnosis quoted above was given when recording the species from the Oak-Tree Clay and was repeated word for word in the section on Lower Oolite fossils, but none was given when recording the species from the Corallian. The reference to the Oak-Tree Clay plate of the Strata ident. is evidently to fig. 8 ("*Venus*"), which represents a common Kimmeridge Clay *Astarte*. It seems most reasonable, therefore, to regard this form as the typical *A. ovata*, and to choose the figured specimen as lectotype. Unfortunately, this specimen is no longer with the rest of Smith's collection, but there can be no doubt as to the identity of the species represented.

To establish the identity of the fossils from other horizons which Smith included in *A. ovata*, it is necessary to examine his collection. Of the Inferior Oolite specimens listed by him, there remain two shells, belonging respectively to *A. obliqua* (Lamarck) and *A. orbicularis*, J. Sowerby, from "between Sherborn and Yeovil," the cast of an indeterminate *Astarte* from "Coal Canal," and the cast of a *Lucina* from Fulbrook. Unfortunately, none of his Corallian specimens are left, but he records that two of the four were internal casts. It is evident that the species was not founded primarily upon the Corallian specimens. Most probably these included the form which J. Phillips (1829, Illustr. Geol. Yorks. i. p. 128, pl. iii. fig. 25) and J. de C. Sowerby (1846, Min. Conch. vii. pl. dcxlv. figs. 1–3) subsequently described as *A. ovata*, but this cannot be definitely proved. The species in question is distinct from the Kimmeridge Clay one to which I consider the name *A. ovata* should be restricted, and hence should be known by the next available name, which seems to be *A. aliena* (Phillips, 1829, *loc. cit.* p. 128, pl. iii. fig. 22, sub *Crassina*).

Chama striata, W. Smith, 1817, Strat. Syst. p. 45.

"Oblong, elongated, curved, longitudinally striated; striæ irregular.

"Bagley Wood Pit. North Wilts Canal." [Oak-Tree (Kimmeridge) Clay.]

Smith, like J. Sowerby, referred exogyrate oysters to the genus *Chama*. Although short, the above diagnosis is sufficient to indicate the identity of his *Ch. striata*, which is, of course, the well-known species usually referred to as *Exogyra virgula* (Defrance). Two specimens, from the North Wilts Canal, remain in his collection. These bear the reference-mark 2 *b*, which corresponds to *Chama striata* in his MS. list. One of them (L. 53452, Pl. XII. fig. 9) is now selected as lectotype; the second (L. 53453) is also figured (Pl. XII. fig. 8).

Smith's was not the earliest name for this important species, for Lamarck, in 1801 (Syst. Anim. s. Vert. p. 399), had listed it as *Gryphæa angustata*. This, however is a *nomen nudum*; all that Lamarck says of it is "Foss. des env. de la Rochelle, communiqué ainsi que le précéd. par le C. Fleuriau-Bellevue de la Rochelle." In 1819 (Hist. Nat. Anim. s. Vert. vi. (i.), p. 200), Lamarck listed the same species as *G. angusta*, and gave a short description, but this was posterior to Smith's *Chama striata*, which must be accepted as the earliest valid name for the species. It must be mentioned that Meuschen, in 1787 (Mus. Gever. p. 454), had previously described another species as *Ch. striata*, but he cannot be accepted as a binomial author (see Winckworth, 1926, Proc. Malac. Soc. xvii. p. 104), and his work does not affect the validity of Smith's name.

Defrance's *Ostrea virgula*, as originally published (1821, Dict. Sci. Nat. xxii. p. 26) was a *nomen nudum*, and his specific name was first properly established by Deshayes (1831, Coq. Carac. des Terrains, p. 90, pl. v. figs. 12–13), long after Smith's publication of *Ch. striata*. Lamarck's types of *G. angusta* have been figured in pl. 200 of the 'Palæontologia Universalis' (1910).

Avicula costata, W. Smith, 1817, Strat. Syst. pp. 46, 57, 61, 67, 81, 107, 112, and reference (p. 81) to Strata. ident., "Clay over the Upper Oolite" pl. fig. 8.

"Oblique, subdepressed, left side extended, acuminated; wings unequal, the right wing short; valves unequal, lower valve convex, with about eight smooth ribs, and undulated internally, upper valve flat, with diverging striæ." (P. 81.)

"Brinkworth Common." [Oak-Tree (Kimmeridge) Clay.]

"Dudgrove Farm." [Clunch Clay and Shale.]

"Kelloways." [Kelloways Stone.]

"Stony Stratford." [Cornbrash.]

"*a* Bradford. *b* Hinton. *c* Winsley." [Clay over the Upper Oolite (Bradford Clay).]

"*a* Between Cross Hands and Petty France. *b* Tucking Mill." [Under Oolite. "Variety, with many ribs."]

"Enstone." [Sand and Sandstone (Inferior Oolite Sands).]

Since Smith's diagnosis of this species was only given on the page on which it was recorded from the Bradford Clay, and the specimen figured by him also came from that horizon, it seems most reasonable to select that specimen as lectotype, although it is no longer in his collection. This interpretation of the species agrees with J. Sowerby's (1819, Min. Conch. iii. p. 77, pl. ccxliv. fig. 1), whose specimen also came from the Bradford Clay. Smith's records of *A. costata* from several other horizons indicate that more than one species was included by him under that name. Specimens from the Kelloways Rock of Kelloways, the Bradford Clay of Hinton, and the Inferior Oolite of Tucking Mill and "between Cross Hands and Petty France" still remain. These are all more or less broken specimens of *Oxytoma* with more ribs than the typical *A. costata.* As is well known, specific discrimination in this genus presents a difficult problem.

Avicula echinata, W. Smith, 1817, Strat. Syst. p. 67, and reference to Strata ident., "Cornbrash" pl. fig. 8.

Smith's diagnosis and list of localities need not be cited, since there has never been any doubt as to the identity of this species, which was adopted by J. Sowerby (1819, Min. Conch. iii. p. 75, pl. ccxliii. fig. 1, *non* fig. 2), and has come into general use. Smith's figured specimen, which may be taken as lectotype, is no longer in his collection, but there is a good series of specimens from "south-west of Tellisford" and several other localities.

Mytilus tunicatus, W. Smith, 1817, Strat. Syst. p. 79.

> "Mytilus tunicatus," or coated muscle. Fistulana. Lam.
> "Combhay." [Clay over the Upper Oolite (Bradford Clay).]

This name apparently originated with Smith, since there is no *Fistulana tunicata* of Lamarck, as the above seems to indicate. Smith's specimen is no longer in existence, and I am unable to suggest to what species it belonged, unless possibly to *Lithodomus inclusus,* Phillips. In any case, Smith's name is a *nomen nudum,* and need not concern us.

Chama crassa, W. Smith, 1817, Strat. Syst. p. 80, and reference to Strata ident., "Clay over the Upper Oolite" pl. fig. 6.

> "Very long, narrow, deep around one side, smooth; beak subinvolute; upper valve flat, tooth of the hinge small, blunt; margin entire within. Length almost three times as great as the breadth.
> "Stoford." [Clay over the Upper Oolite (Bradford Clay).]

Smith's type is no longer extant, but there can be no doubt that his *Chama crassa* is the same species as that described by Lycett (1863, Supplementary Monogr. Moll. Stonesfield Slate, Great Oolite, etc., p. 108, pl. xxxii. figs. 2, 2 *a*, 2 *b*) as *Ostrea* (*Exogyra*) *lingulata,* Walton MS. A specimen of this species, agreeing closely with Smith's figure, is in the British Museum collection (L. 13648, F. Ellis coll.).

Terebratula reticulata, W. Smith, 1817, Strat. Syst. p. 83, and reference to Strata ident., "Clay over the Upper Oolite" pl. fig. 10.

> "Obtusely five-sided, gibbous; with minutely echinated or reticulated striæ; surface uneven; larger valve with two very prominent folds continued from the front to the beak, and three large depressions, forming large angular notches on the front; upper valve with corresponding undulations.
> "*a* Farley. Bradford. Stoford. *b* Hinton. *c* Winsley. *d* Pickwick."

Smith's figured specimen (B. 1430) is still in his collection, and is now designated as lectotype. As J. Sowerby first pointed out

(1821, Min. Conch. iv. p. 7), *T. reticulata* is a synonym of Parkinson's *Terebratulites coarctatus* (1811, Org. Rem. iii. p. 229, pl. xvi. fig. 5). Sowerby proceeded to transfer Smith's name to another form—"supposing this to be *T. coarctatus* of Parkinson, I have retained that name for it, and applied Smith's name to the following, which either he did not know or did not think to be a distinct species." This, of course, is inadmissible.

Ammonites modiolaris, W. Smith, 1817, Strat. Syst. pp. 88, 100, and reference to Strata ident., "Fuller's Earth Rock" pl. fig. 2.

"Subglobose, inner volutions convex, exposed within a large conical hollow or umbilicus; back wide; aperture semilunate, rounded at the extremities, three times as wide as long.

"The inner volutions are convex and sharply undulated within the umbilicus, with many large furrows across the back curving toward the aperture; the outer volutions are irregularly swelled on the inner edge, and the undulations across the back are obscure. The umbilicus is one-third of the greatest diameter.

"This species may be distinguished from *Ammonites sublævis* by the large size of the umbilicus, and the obtuseness of the angle which bounds it.

"Dundry. Rowley Bottom." [Fuller's Earth Rock.]

"Lansdown." [Under Oolite.]

The name *modiolaris* dates from E. Lhwyd, 1699—"Nautilus modiolaris; sive conglobatior majusculus, rotæ modiolum referens. Ad ripam Avonæ juxta Callaway-Bridge in Wiltonia" (Lithoph. Britann. Ichnogr. p. 18, pl. vi. fig. 292). Smith's, however, was the first post-Linnean description of an *Ammonites modiolaris*, the next being d'Orbigny's (1848, Pal. Franç. Terr. Jurass. i. p. 468, pl. clxx.). Although Lhwyd's specimen came from the Callovian, Smith does not use the name for any specimens from that horizon, but refers such to J. Sowerby's *A. sublævis* (1814, Min. Conch. i. p. 117, pl. liv.).

No specimens included by Smith in *A. modiolaris* now remain in his collection. Hence the name must be restricted to the Fuller's Earth form figured by him. This is evidently a *Tulites* of the group of *T. subcontracta* (Morris & Lycett), but whether it is identical with any previously described form cannot be decided until a thorough revision of the genus is undertaken. In any case, d'Orbigny's *A. modiolaris* can no longer stand; since his figure is obviously very untrustworthy, this is perhaps fortunate.

Modiola anatina, W. Smith, 1817, Strat. Syst. p. 89, and reference to Strata ident., "Fuller's Earth Rock" pl. fig. 3.

"Oblong, very gibbous, smooth; beaks prominent, hooked, subinvolute; one side arched into the front; the other oval, flat or concave with a very thick blunt projection near the beaks; shell with fine striæ or lines of growth. Length twice the width, thickness two-thirds of the length. In a side view the shell is regularly oval with a notch between the beaks.

"Ancliff." [Fuller's Earth Rock.]

No specimens of Smith's *M. anatina* now remain in his collection, but his figure leaves no doubt as to the identity of the species with J. Sowerby's *Modiola gibbosa* (1818, Min. Conch. iii. p. 19, pl. ccxi. fig. 2). When describing the latter, Sowerby actually puts Smith's name in synonymy! There is, of course, a Linnean *Mytilus anatinus* (1758, Syst. Nat. edit. 10, p. 706), but, unless *Modiola* is considered as a subgenus of *Mytilus*, Smith's name must stand.

Mya intersectans, W. Smith, 1817, Strat. Syst. p. 92.

"Depressed, wide, anterior side expanded; covered by intersecting furrows, longitudinal on the anterior part, oblique on the posterior part, meeting in an oblique line: beaks prominent, nearest to the posterior end."

Fuller's Earth Rock. No locality mentioned.

As mentioned previously, Smith used the terms "anterior" and "posterior" in the opposite sense to that understood at the present day, while his "longitudinal" means the direction perpendicular from the umbo to the ventral margin, and "wide" means what we should now call "elongate." If we bear these points in mind, it is clear that *Mya intersectans* is a *Goniomya*. Smith's holotype (L.1672, Pl. XII. fig. 4) is still extant, its locality being unrecorded. It undoubtedly belongs to the same species as J. Sowerby's *Mya angulifera* (1819, Min. Conch. iii. p. 46, pl. ccxxiv. figs. 6, 7), which also came from the Fuller's Earth. Smith's diagnosis is sufficient to distinguish this species from *Goniomya literata* (Parkinson), which has also been recorded from the same horizon. In *G. intersectans* (=*angulifera*) the umbones are prominent and very anterior (for the genus), while the ornamental ridges are oblique on the anterior part of the shell and almost perpendicular to the hinge-margin on the posterior part, the two series meeting in an oblique line. In *G. literata* the umbones are more median, and the ridges oblique on both parts of the shell, the two series meeting in a sub-vertical line.

Ostrea rugosa, W. Smith, 1817, Strat. Syst. pp. 92, 106.

"Valves equal, oblong, depressed, one side eared; very rough, with eight or more broad longitudinal ridges elevated into projecting spinous tubercles: hinge square, flat, pit hollowed, with straight parallel edges, the posterior end curving to the beak. The shell is uncommonly thick; the hinge very massive, and projecting far into the shell; one of the flat lateral parts forms a rectangular ear.

"*a* Monkton Combe. *b* Between Nunny and Frome." [Fuller's Earth Rock.]

"*a* Tucking Mill. *b* Between Sherborn and Yeovil. This is smaller, more regular and thinner." [Under Oolite.]

Smith's description is quite adequate for recognition of this species, and, of the four specimens referred to by him, three (L. 1791, Fuller's Earth of Monkton Combe, L. 1692, Fuller's Earth between Nunny and Frome, L. 1771, Inferior Oolite of Tucking Mill) still remain in his collection. I now select specimen L. 1791, from the Fuller's Earth, as lectotype. The species is, of course, identical with Schlotheim's *Ostracites pectiniformis* (1820, Petrefactenk. p. 231). J. Sowerby's *Lima proboscidea* (1820, Min. Conch. iii. p. 115, pl. cclxiv.), from the Callovian, is doubtfully distinct from the Bajocian-Bathonian form. Smith's name for this important species, which is now referred to the genus *Ctenostreon*, is hence the earliest by three years.

Ammonites calix, W. Smith, 1817, Strat. Syst. p. 100.

> "Discoidal, concave or cup-shaped, radiated; back wide, slightly convex; radii prominent, rather distant, terminating in tubercles, and forming a deeply indented margin to the cup; tubercles dividing over the back into three transverse ribs: aperture much wider than long.
>
> "The longest diameter in one specimen is five inches. The transverse ribs are in number about three to each tubercle, on the outer volutions four, or more. The aperture is a portion of a circular ring bounded by two radiating lines.
>
> "Sherborn." [Under Oolite.]

One specimen of this species, bearing the mark K2, still remains in Smith's collection. This specimen (C. 671, Pl. XII. figs. 10 *a*, *b*), which may be taken as lectotype, is about 62 mm. in diameter, but obviously not complete. It is undoubtedly conspecific with J. Sowerby's *A. brodiæi* (1822, Min. Conch. iv. p. 71, pl. cccli.), and is referable to the genus *Stephanoceras*. Smith's name, having five years' priority, should therefore replace Sowerby's for the species.

Amonites radiatus, W. Smith, 1817, Strat. Syst. p. 101.

Smith's diagnosis of this species, recorded from the Inferior Oolite "between Sherborn and Yeovil," need not be quoted, since the specific name had been used for an entirely different species by Bruguière in 1789 (Encyclop. Méth. (Vers), i. p. 42). Smith's specimen (G. 674) is still in his collection; it belongs to the species *Witchellia læviuscula* (J. de C. Sowerby, 1824, Min. Conch. v. p. 73, pl. cccclí. figs. 1, 2).

Ammonites undulatus, W. Smith, 1817, Strat. Syst. p. 114.

> "Depressed, radii obtuse, mostly equal in length, twice curved, undulating the back; volutions four or more, depressed along the middle, the inner ones three fourths concealed: aperture very oblong, inner edges truncated.
>
> "The radii are obscure towards the center, twice curved, and on the back incline toward the aperture, and are so prominent as to give it the appearance of being folded or plaited. In some specimens the radii seem closer and more numerous on the outer volutions than on the inner.
>
> "Coal Canal." [Marlstone.]

One of Smith's specimens of this species (C. 33499, Pl. XII. figs. 5 *a*, *b*) is still extant, and may be taken as lectotype. It belongs to Oppel's *A. wechsleri* (1863, Palaeont. Mittheil. p. 135, pl. xliii. figs. 1 *a*, *b*), which is found in the *jamesoni*-Zone of the Lower Lias and is now referred to the genus *Tragophylloceras*. The sandy facies of this zone in places in the Radstock district, where Smith's specimen was found, evidently led him to regard the beds as equivalent to the Marlstone of the Middle Lias.

SUMMARY OF CHANGES IN NOMENCLATURE ADVOCATED IN THIS PAPER.

Usual Name.	Correct Name.
Inoceramus involutus, J. de C. Sowerby.	*I. cuvieri*, J. Sowerby MS., Smith.
Pleurotomaria perspectiva (Mantell) ...	*P. depressa* (J. Sowerby MS., Smith).
Ostrea deltoidea, J. Sowerby..............	*O. delta*, Smith.
Anabacia orbulites (Lamouroux)	*A. porpites* (Smith).
Euhoplites tuberculatus (J. Sowerby) ...	New name required.
Cidaris sceptrifera, Mantell	*C. cucumerina* (Smith).
Pecten (*Neithea*) *cometa*, d'Orbigny	*P.* (*N.*) *sexcostatus*, Smith.
Pecten (*Neithea*) *sexcostatus*, Woodward.	*P.* (*N.*) *dutemplei*, d'Orbigny.
Astarte ovata (Phillips)	*A. aliena* (Phillips).
Exogyra virgula (Defrance)	*E. striata* (Smith).
Exogyra lingulata (Lycett)	*E. crassa* (Smith).
Cadoceras modiolaris (d'Orbigny).........	New name required.
Modiolus gibbosus (J. Sowerby)	*M. anatinus* (Smith).
Goniomya angulifera (J. Sowerby)	*G. intersectans* (Smith).
Ctenostreon pectiniforme (Schlotheim)...	*Ct. rugosum* (Smith).
Stephanoceras brodiæi (J. Sowerby)......	*S. calix* (Smith).
Tragophylloceras wechsleri (Oppel)	*T. undulatus* (Smith).

ACKNOWLEDGMENTS.

It remains for me to express my thanks to those who have helped me in the preparation of this paper: Dr. L. F. Spath, for advice concerning the identification of Smith's ammonite species; Mr. C. D. Sherborn, for looking up several points in the unpublished part of his 'Index Animalium'; Miss H. M. Muir-Wood, for determining the brachiopod associated with *Inoceramus cuvieri*; and Mr. A. G. Brighton, for advice concerning the genus *Galea*.

EXPLANATION OF PLATE XII.

(All the figures are of natural size.)

Fig. 1. *Pleurotomaria depressa* (J. Sowerby MS., Smith). Holotype, G. 1573. Lower Chalk of Warminster, Wilts.

Fig. 2. *Cidaris cucumerina* (Smith). Lectotype, E. 473. Chalk of Surrey.

Fig. 3. *Pecten* (*Neithea*) *sexcostatus*, Smith. Holotype, L. 1472. Upper Greensand of Chute, near Warminster, Wilts.

Fig. 4. *Goniomya intersectans* (Smith). Holotype, L. 1672. Fuller's Earth; locality unrecorded.

Figs. 5 *a*, *b*. *Tragophylloceras undulatus* (Smith). Lectotype, C. 33499. Lower Lias of the Coal Canal, near Radstock, Somerset.

Fig. 6. *Opis currirostra* (Smith). Neotype, L. 53454. Kimmeridge Clay of Wootton Bassett, North Wilts.

Fig. 7. *Opis currirostra* (Smith). Uncrushed specimen, 24562. Kimmeridge Clay of Wootton Bassett, North Wilts.

Fig. 8. *Exogyra striata* (Smith). Syntype, L. 53453. Kimmeridge Clay of the North Wilts Canal.

Fig. 9. *Exogyra striata* (Smith). Lectotype, L. 53452. Kimmeridge Clay of the North Wilts Canal.

Figs. 10 *a*, *b*. *Stephanoceras calix* (Smith). Lectotype. C. 671. Inferior Oolite of Sherborne, Dorset.

XXX.—*On the Apterygota collected in British Guiana by the Oxford University Expedition of* 1929. By H. Womersley, A.L.S., F.E.S.

Perhaps in no part of the Tropics has the Apterygota fauna been less collected than in the northern part of South America. The entomologists of the expedition from Oxford University which explored the tropical forest in the neighbourhood of Moraballi Creek, Essequibo River, in British Guiana, are to be congratulated on the fact that, while concentrating their attention on the life in the "canopy," the ground-fauna was not altogether neglected.

The collection of Thysanura and Collembola brought back, although small in both species and specimens, nevertheless is of the greatest interest, and I am very grateful to Dr. O. W. Richards for the opportunity of studying it and describing the species.

The species contained in the collection are:—

THYSANURA.

Machilidæ.

Meinertelloides richardsi, sp. n.

COLLEMBOLA.

Poduridæ.

Ceratrimeria pentoculata, sp. n.

Entomobryidæ.

Acanthocyrtus guianiensis, sp. n.
—— *croceus*, sp. n.
Campylothorax camelina, sp. n.

Order THYSANURA, Lubb.

Family **Machilidæ**, Grassi.

Subfamily *Meinertellinæ*, Carp.

The single species of Machilid collected by the expedition belongs to the subfamily Meinertellinæ of Carpenter, 1916 (Meinertelloidæ, Verhff.), as distinguished by all the abdominal sternites having very small triangular median parts and by not having more than a single pair of exertile vesicles on any segment.

The species from British Guiana, however, differs so very much from the described genera of this subfamily that it seems advisable to erect a new genus for it, for which I propose the name

MEINERTELLOIDES, gen. nov.

Diagnosis.—Facies of the general Machilid type. Body scaled and mottled with purplish pigment, especially on the face. Antennæ longer than the body, not scaled? Maxillary palpi long, second joint at base with a long conical process, subapically above the usual outer triangular process, with two small, lateral, backwardly directed processes; third joint in male sex apically with a strong and broad curved hook.

All legs without coxal processes, the last joint of tarsus truncate and in male sex with a subapical pair of scopulæ of fine dense black hairs.

Median portion of abdominal sternites very small. Sternites i.–vii. with a single pair of vesicles. Pleurites ii.–vii. produced into long and broad lobes.

Gonapophyses absent, penis short. Ovipositor moderately long.

Gen. type, *Meinertelloidcs richardsi*, sp. n.

To show the relationship of this genus to the other described genera I give the following table:—

Subfamily *MEINERTELLINÆ*, Carp.

1.	Exertile vesicles on sternites i.–vii.	2.
	Exertile vesicles only on sternites ii.–iv. Legs ii. and iii. with coxal processes	Genus *Allomachilis*, Silv.
2.	Coxal processes on legs ii. or iii. or both....	3.
	Coxal processes wanting on all legs........	4.
3.	Coxal processes on both legs ii. and iii. Gonapophyses on abdominal segments viii. and ix.	Genus *Machiloides*, Silv.
	Coxal processes only on legs iii. and abortive. Gonapophyses absent	Genus *Hypomachilodes*, Silv.
4.	Male sex without scopulæ to tarsi	6.
	Male sex with scopulæ of dense fine black hairs	5.
5.	Both sexes with scopulæ on tarsi. Gonapophyses absent? Pleurites not produced?	Genus *Meinertellus*, Silv.
	Male sex only with scopulæ. Gonapophyses absent. Pleurites produced in prominent lobes	Genus *Meinertelloides*, nov.
6.	Paired ocelli not elongate, subrotund, and almost touching lower edge of eyes. Gonapophyses absent?...............	Genus *Machilinus*, Silv.
	Paired ocelli transverse	7.

7. Eyes very much larger than usual. Sternites of abdominal segments almost invisible. Paired ocelli elongate and transversely oblique .... Genus *Macropsontus*, [Silv.
Eyes normal. Sternites of abdominal segments medially distinctly visible. Paired ocelli elongate, transverse .... Genus *Machillelus*, [Silv.

This new genus agrees with *Machiloides* in the structure of the second and third joints of the maxillary palpi, but differs as in the above table in not possessing stylets to the coxæ of the second and third legs. The tarsal scopulæ is a character found also in the genus *Corethromachilis* described by Carpenter from the Seychelles.

Meinertellus occurs in Venezuela and *Machilinus* is known from French Guiana as well as California and Europe. *Hypomachilodes* is found in Texas, *Machilletus* in Mexico, *Machiloides* in Madagascar, America, and Spain, while *Allomachilis* is so far restricted to Australia.

The species from British Guiana is most closely related to *Meinertellus pulvillatus*, Silv., from Venezula.

Meinertelloides richardsi, sp. n. (Figs. 1–8.)

Diagnosis.—Length of body 10 mm. Body scaled. Colour in spirit dark brown, in life probably with the usual reflections of the Machilids. Beneath the scales the colour is lighter, with purple mottlings, especially on face. Antennæ, legs, and stylets not scaled, but with purple mottling.

Eyes large (fig. 1), touching broadly in the middle line, lower edge forming a rather obtuse angle. Paired ocelli transverse, narrow in the middle, black, widely separated. Single ocellus inversely cordate, on a distinct prominence. Sides of head produced frontally in obtuse lobes. Antennæ longer than the body, white, with narrow brown bands on about every twelve to thirteen segments, second joint three times as long as broad. Maxillary palpi (figs. 2–3) long, seven-jointed, ratio of joints in male $2\frac{1}{2} : 4 : 4 : 3\frac{1}{2} : 5 : 4\frac{1}{2} : 3\frac{1}{2}$, in female $2\frac{1}{2} : 2\frac{1}{2} : 2 : 2\frac{1}{2} : 3 : 2\frac{1}{2} : 2$, second and third joints as in generic description. Lacinia broad and as long as galea. Labial palpi similar in both sexes, apical joint as in fig. 7, with numerous sensory setæ ("Sinneskegeln"). Mandibles (fig. 4) rather shorter in male than female, with five blunt teeth.

Thorax only moderately arched. Legs fairly long, last joint of tarsus truncate and in male with two dense pads of fine black hairs subapically (fig. 8). Second and third coxæ without stylet-like processes.

Abdomen: sternites (fig. 5) with very small median portion, i.–vii. with a single pair of exertile vesicles. Pleurites ii.–vii. produced into long prominent lobes (fig. 5). Stylet ix. longer than corresponding coxæ, with apical spine $\frac{3}{4}$ its length. The posterior edge of sternite ii. outside of base of stylet has a number of fine spines or setæ.

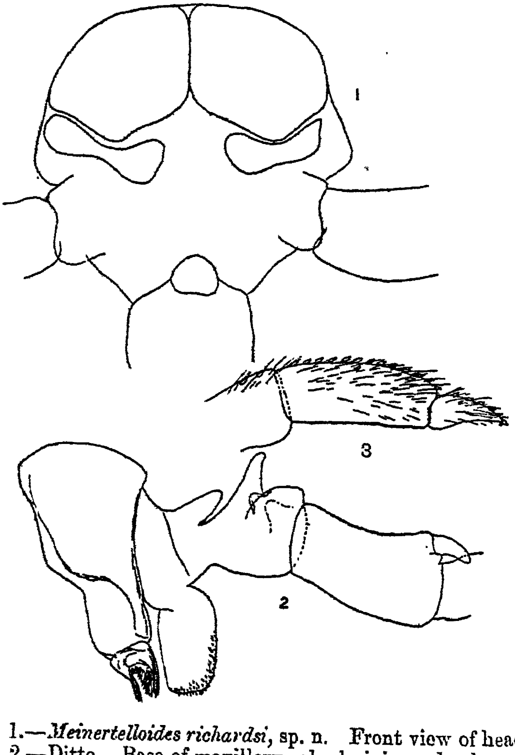


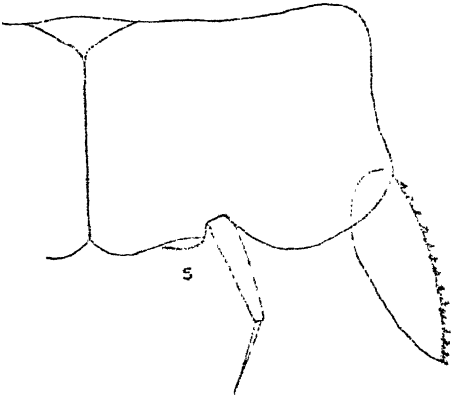
Fig. 1.—*Meinertelloides richardsi*, sp. n. Front view of head.
Fig. 2.—Ditto. Base of maxillary palp, lacinia, and galea.
Fig. 3.—Ditto. Apex of maxillary palp.

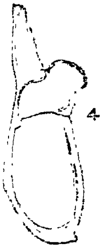
Penis short and of characteristic form (fig. 6). Gonapophyses absent.

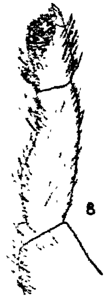
Ovipositor long, reaching beyond stylet ix., annulated.

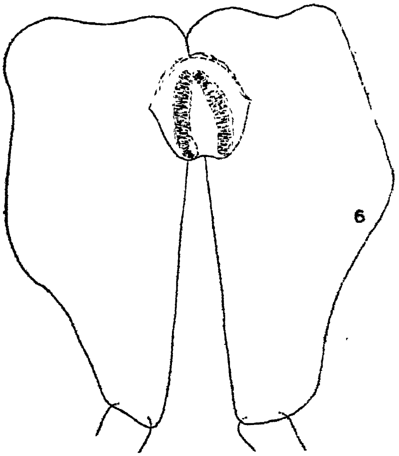
Median cercus almost as long as body, lateral cerci about $\frac{3}{4}$ length of median.

Locality.—Moraballi Creek, Essequibo River, British Guiana. Coll. O. W. Richards. 1 male, no. 2214, 12/ix./29; 1 female, no. 2258, 12/ix./29; 1 male, no. 1797, 8/ix./29.









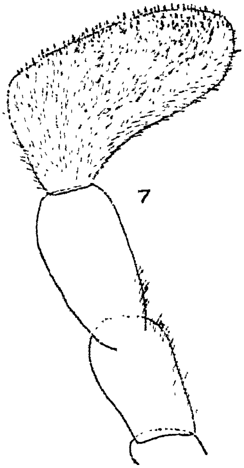


Fig. 4.—*Meinertelloides richardsi*, sp. n. Mandible.
Fig. 5.—Ditto. Sternite iv. of abdomen.
Fig. 6.—Ditto. Subcoxæ ix. and penis.
Fig. 7.—Ditto. Labial palp.
Fig. 8.—Ditto. Tarsus of male.

Type male 3 slides of dissections in British Museum.
Type female 2 slides of dissections in British Museum.

Order COLLEMBOLA, Lubbock.

Family Poduridæ, Lubbock.

Subfamily *ACHORUTINÆ*, Börner.

Genus CERATRIMERIA, Börner.

Ceratrimeria pentoculata, sp. n. (Figs. 21–26.)

Diagnosis.—Length 4 mm. Colour deep blue except on mouth-parts, tibio-tarsi, tip of third and whole of fourth antennal joints, and a patch at apex of abdomen, which are white to ivory-yellow.

Antennæ nearly twice as long as head diagonal (7 : $4\frac{1}{2}$), ratio of antennal joints $1\frac{1}{2} : 2 : 1 : 2\frac{1}{2}$; antennæ iv. with a trilobed apical knob, without olfactory hairs. On inner edge and extending in a patch on ventral surface (fig. 22) are numerous small setæ. Subapically on iv. on the outer edge is a pair of short slightly curved sensory setæ lying in a fold. Sensory organ of antennæ iii. inconspicuous, consisting of two short setæ arising direct from the surface and not in a groove. Mouth-parts produced in a strong cone or snout almost half as long as the head diagonal ($1\frac{3}{4} : 4\frac{1}{2}$).

Eyes, five on each side, ocelli large. Postantennal organ conspicuous, of numerous small lobes, half the diameter of an anterior ocellus (fig. 24). Legs strong with numerous (compared to the rest of the body) strong spines. Upper claw strong, much curved, with a prominent outer tooth $\frac{1}{3}$ from apex (fig. 25). The whole claw is surrounded by a well-developed pseudonychium or sheath, which is apically bluntly pointed at a little before the apex of claw. Basally the sheath has a pair of lateral wing-like expansions. Lower claw absent. Clavate hairs absent.

Furca present, but details not observable. Rami with three barbs, the medial and basal of which are paired.

Clothing of sparse but strong setæ.

Locality. — Moraballi Creek, Essequibo River, British Guiana. 1 specimen. Coll. O. W. Richards, no. 2132, 15/ix./29.

Type-slide in the British Museum.

In size this species comes close to *Ceratrimeria maxima*, Schött, from New Guinea and the Sunda Isles, but differs from it as well as from the others of the genus, *C. pulchella*, Handschin, from the Philippines, and *C. longicornis*, Handschin, from Java, in the number of ocelli and in the very pronounced structure of the claws.

Family Entomobryidæ, v. D.T.

Subfamily *ENTOMOBRYINÆ*, Schffr., Börner.

Tribe ENTOMOBRYINI, Börner.

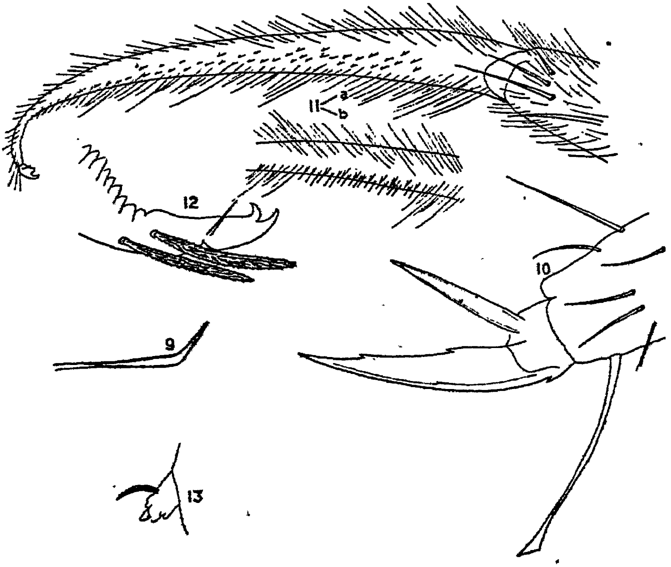
In 1906 Börner established *Acanthurella* as a subgenus of *Lepidocyrtus* for *A. braueri,* Börner, from the Seychelles, on the fact that the dentes were spined. Handschin, in 1925, discusses the classification of the Lepidocyrti very fully, and, while raising *Acanthurella* to generic rank, erects the closely related genus *Acanthocyrtus* for the species described from Australia by Schött as *L. spinosus* in 1917. He separates these two genera as follows :—

Dornen einreihig, Antennen ungeringelt.... Gen. *Acanthurella,* Börner.
Dornen mehrreihig, Ant. iv. geringelt .... Gen. *Acanthocyrtus* [Handschin.

In looking over Schött's description of *L. spinosus,* I am unable to find any reference to the fourth antennal joint being ringed, and this character therefore hardly appears to be valid. Handschin in this paper then redescribes *Acanthurella javana,* Börner, and describes *A. amethystina* from the Sunda Isles.

In 1925 Schött again discusses this question, and agrees with Handschin in placing *spinosus* in a separate genus to *Acanthurella,* pointing out that it differs in having pointed scales, retractile terminal knob on ant. iv., two-jointed tibiæ, and simple dental spines, these being the reverse in *Acanthurella* proper. He describes *Acanthurella zonata,* sp. n., and *glauca,* sp. n., from Northern Sarawak, in both of which the dental spines are serrated. Actually in the species described by Börner and Handschin no mention of the serration of the dental spines is made, nor do their drawings indicate such, the spines appearing to be quite simple. It seems, therefore, uncertain whether the serration of the dental spines should be regarded as a generic character or not.

In the collection from British Guiana are two species which are somewhat difficult to place in either *Acanthurella* or *Acanthocyrtus.* Both species are typically Acanthurelline in general characters, but, instead of possessing a multiple series of similar spines, as in *spinosus,* or a single row, as in the species of *Acanthurella,* the dentes have two or three series of spines of various forms. In neither of the species, however, are the spines quite so large or of the same shape as those described for the different species of *Acanthurella*. Further, only in one form do I find the divided tibio-tarsus of *Acanthurella*, and then only on the hind pair of legs.



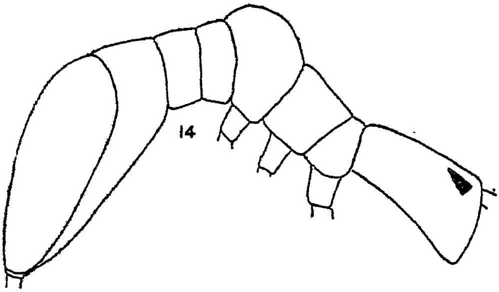
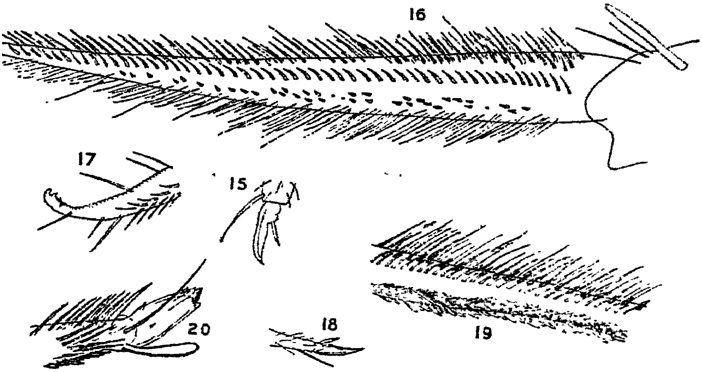


Fig. 9.—*Acanthocyrtus guianiensis*, sp. n. Seta from thorax iii.
Fig. 10.—Ditto. Claws.
Fig. 11.—Ditto. Furca, inside view (*a*), outside (*b*).
Fig. 12.—Ditto. Mucro.
Fig. 13.—Ditto. Rami.
Fig. 14.—*Campylothorax camelina*, sp. n. General aspect from side.

Although therefore the general chætotaxy of the dentes is very different from that of *Acanthocyrtus spinosus*, on Handschin's separation I am disposed to place them in this genus. Probably, however, his genus will ultimately be



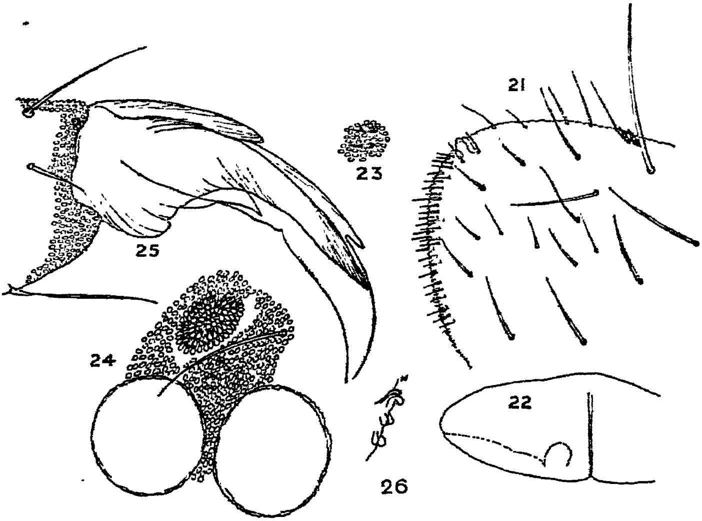


Fig. 15.—*Acanthocyrtus croceus*, sp. n. Claws.
Fig. 16.—Ditto. Dentes from inside.
Fig. 17.—Ditto. Mucro.
Fig. 18.—*Campylothorax camelina*, sp. n. Claws.
Fig. 19.—Ditto. Dentes from inside.
Fig. 20.—Ditto. Mucro.
Fig. 21.—*Ceratrimeria pentoculata*, sp. n. Apex of ant. iv.
Fig. 22.—Ditto. Outline of ant. iv., showing area of fine setæ.
Fig. 23.—Ditto. Ant. organ iii.
Fig. 24.—Ditto. Postant. organ and anterior ocelli.
Fig. 25.—Ditto. Claw.
Fig. 26.—Ditto. Rami ; M=tip of mucro.

sunk and all the forms placed in the one comprehensive genus *Acanthurella*. In both forms from British Guiana the antennæ are of considerable length, being very much longer than the other species of this group of Collembola.

Genus ACANTHOCYRTUS, Handschin, 1925.

Acanthocyrtus guianiensis, sp. n. (Figs. 9–13.)

Diagnosis.—Length (excluding appendages) 2·8 mm. Colour purplish black, but light yellow on back of head and medio-dorsal part of th. ii. and abd. i.–iv., tip of abd. iv. all purplish, vi. all yellow. The whole body is covered with numerous hairs and scales. Manubrium and femora purplish, rest of appendages yellow except tip of ant. iv.

Antennæ longer than body (3·15 mm.), ratio of joints $=3\frac{1}{2} : 4 : 3\frac{1}{2} : 7$; basal two joints with several long setæ, otherwise with numerous hairs. Ant. i. just beyond base with a characteristic black double dot; ant. iv. unringed and apparently without apical exertile knob; ant. i. at least scaled.

Eyes 8+8 on black patches.

Thorax.—Mesonotum slightly overlapping head. Ratio of head-length to th. ii. and th. iii. $=3\frac{1}{2} : 2 : 1$. Thorax ii. with anterior collar of straight pointed setæ, iii. with many long but apically bent setæ (fig. 9), finely ciliated on upper edge of bent portion. Legs long and slender, with numerous strong spine-like setæ. Fore and middle legs with tibiotarsi : femora $=4 : 3$, hind legs $6\frac{1}{2} : 4$, hind tibio-tarsus doubtfully subdivided. Upper claw (fig. 10) with small outer basal tooth and two inner teeth; lower claw lanceolate and unarmed, reaching slightly beyond distal tooth of upper claw. Tibio-tarsus with a single long spathulate tenent-hair as long as upper claw.

Abdomen.—Ratio of segments i. : ii. : iii. : iv. : v. : vi. $=\frac{1}{2} : 1 : 1 : 6\frac{1}{2} : 1 : 1$; segments iii. and iv. with lateral sensory setæ ("bothriotriche"). Furca long, 1·925 mm., ratio of manubrium : mucrodens $=5 : 6$. Manubrium apically with a bunch of long pointed spines. Dentes (fig. 11) with a complicated system of spines as follows :—on inside near ventral edge an irregular, more or less double row of small scale-like spines (fig. 11 *a*), above these on medial part of ventral edge a short series of needle-like spines (fig. 11 *b*). Dentes annulated towards tip and apparently not scaled. Mucro (fig. 12) small, with two teeth and basal spine.

Rami with strong curved basal spine (fig. 13). Scale long and pointed.

Locality.—Moraballi Creek, Essequibo River, British Guiana. Coll. O. W. Richards, no. 2009, 1 specimen, 12/ix./29.

Type in the British Museum.

Acanthocyrtus croceus, sp. n. (Figs. 15–17.)

Diagnosis.—Length (excluding appendages) 2·625 mm. Colour yellowish, slightly browner on head and dorsum. Eye-patches black. Tip of posterior femora, anterior tibiotarsi, tips of ant. i., ii., iii. and distal half of iv. bluish black.

Antennæ unscaled, nearly as long as body (2·54 mm.), ratio of joints $=2\frac{1}{2} : 3 : 2\frac{1}{2} : 6\frac{1}{2}$, all joints thickly covered with short hairs, a few long setæ on basal joints. Ant. iv. unringed, apparently without apical lobe.

Head about twice as long as th. ii., which does not overlap. Eyes 8+8 on black patches. Ratio of head : thorax ii. : iii. $=21 : 1\frac{1}{2} : 1$. Legs fairly long and thickly haired, femora with some long setæ. Anterior and middle tibiotarsi about half as long as femora, hind tibio-tarsus nearly twice as long as femur, subdivided at $\frac{3}{5}$ from base. Upper claw (fig. 15) small, unarmed, lower claw simple and lanceolate, tibio-tarsus with a single spathulate tenent-hair.

Ratio of abdominal segments $= \frac{1}{2} : 1 : 1\frac{1}{2} : 5\frac{1}{2} : 1 : \frac{3}{4}$. Furca 1·65 mm.; ratio of manubrium : mucrodens $=4\frac{1}{2} : 4\frac{1}{2}$. Dentes (fig. 15) with complex system of spines as follows:—on inside near ventral edge a more or less double row of small scale-like setæ, above these a single row of strong curved needle-like spines, extending almost to the base of mucro; on dorsal edge a series of longer straight spines which extends over on to the outer side. Apex of manubrium with a single (apparently) straight, pointed, spine-like seta. Mucro small, with two teeth and basal spine (fig. 16). Rami with a strong slightly curved basal spine. Scales long and pointed.

Locality.—In humus, floor of dark forest. Moraballi Creek, Essequibo River, British Guiana. Coll. O. W. Richards, no. 2971, 1 specimen, 27/ix./29.

Type in the British Museum.

Tribe PARONELLINI, Börner.

Genus CAMPYLOTHORAX, Schött.

This genus was established in 1893 by Schött for *Campylothorax longicornis* from the Cameroons, in which the metathorax is strongly pronounced, giving the insect a very curious humped appearance. He was of the opinion that it was the same species as that described by Oudemans as *Entomobrya longicornis* from India. As pointed out by Handschin, the genus is somewhat closely related to *Idiomerus*, Imms, from India, but in this genus it is the mesothorax which is arched.

The species here described from British Guiana is very closely related to *C. longicornis*, Schött, but differs in having spined dentes and in the relative lengths of the head and mesothorax. If the presence or absence of dental spines is of the generic importance that is implied in the genera previously discussed, then a new genus may have to be erected for this species.

Campylothorax camelina, sp. n. (Figs. 14, 18–20.)

Diagnosis. — Length (excluding appendages) 2·9 mm. Colour purplish, a little lighter on sides of head and thorax and the front of thoracic and abdominal segments; the deeper pigment on distal part of abd. iv. extends forward in four or five longitudinal streaks. Legs and furca purplish. Antennæ (incomplete) dirty yellow on basal joint.

Antennæ probably very long, basal joint : head diagonal $=7 : 3\frac{1}{2}$. Head slightly more than twice as long as thorax ii., not overlapped; the front dips suddenly, forming a sharp angle just in front of eye-patches. Eyes 6+6 on black patches triangular in shape. Under the head is a prominent beard of long scales.

Thorax ii. : iii. $= 1\frac{1}{2} : 2\frac{1}{4}$, iii. strongly convex (fig. 14). Legs long and slender; upper claw (fig. 17) with two inner teeth and a basal outer tooth; lower claw simple, lanceolate, with medial inner tooth, half as long as upper claw, no clavate hair.

Abd. i. : ii. : iii. : iv. : v. : vi. $= 1 : 1 : 1\frac{1}{2} : 5 : \frac{1}{2}$: ?.

Furca 1·75 mm.; manubrium : dentes : mucro $= 4 : 5\frac{1}{2} : \frac{1}{2}$, dentes (fig. 18) with an inner medial series of strong but fine slightly curved spines and an inner upper series of broader spines. Dentes scaled. Mucro (fig. 19) of Paronelline form, broad and long, with two apical teeth, one subapical tooth, an inner tooth at about $\frac{1}{3}$ from base, and a small lateral tooth in line with inner one. Apex of dentes with scale-like lobe and a long outer scale $\frac{3}{4}$ the length of mucro. Scales long and rounded apically.

Locality.—At foot of tree in jungle, Moraballi Creek, Essequibo River, British Guiana. Coll. O. W. Richards, no. 5158, 1 specimen, 31/x./29.

Type in the British Museum.

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XXXI.—*The Fauna of the Weevil "Sack-band."*—I.

By A. M. MASSEE, The Research Station, East Malling, Kent.

EXPERIMENTS in relation to the control of the Apple-blossom Weevil (*Anthonomus pomorum* (L.), Curt.) have been in progress at East Malling during the past ten years, and it has been found that a large number of weevils may be trapped in "sack-bands" which are placed around the trees for this purpose. Full particulars of this trapping method will be found elsewhere *.

During the course of these investigations, numerous insects other than the Apple-blossom Weevil have been found in the "sack-bands" from time to time, and in the present paper it is proposed to give a list of the commoner insects, mites, etc., noted in the bands, together with a few details where necessary.

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* "The Control of the Apple-blossom Weevil." By A. M. Massee. Journ. of Pom. & Hort. Sci. 1924–25, iv. pp. 24–37.

More species of Coleoptera have been found in the bands than any other order of insects, 54 different species being recorded at various times. Of these, the Apple-blossom Weevil proved to be the commonest. Sometimes as many as three hundred have been collected from a single band. The Clay-coloured Weevil, another serious fruit-pest, also occurs in large numbers, especially in some seasons—*i. e.*, 1927. Other important pests frequenting the bands are as follows:—The Pea and Bean Weevil, the Strawberry Anthonomus, the Apple-bud Weevil, the Green Leaf-eating Weevil, the Brown Leaf-eating Weevil, and several species of Flea Beetles. On the other hand, several beneficial beetles, such as the Lady-Birds, commonly occur in the bands. The rare weevil, *Anthonomus cinctus*, Koll., has been taken in some numbers, but this species is never very common. One specimen of *Helophorus brevipalpis*, Bed., var.?, was captured in 1927, but this beetle has not been found again in the sacking.

Four species of Capsids are found in the bands, of these, *Lygus pratensis* and *L. campestris* are the more common. The Anthocorid bug, *Anthocoris nemorum*, L., also hibernates in the sacking and is sometimes very abundant.

Probably the commonest insect met with, apart from the Apple-blossom Weevil, is the Earwig, *Forficula auricularia*, L.

The Rosy Apple Aphis (*Anuraphis roseus*, Baker) migrates from the apple-foliage during the latter part of June or in July and goes into the bands for shelter. This phenomenon usually takes place during a spell of very hot weather. After remaining in the bands for a few days the aphids are parasitized and remain attached to the band in a dried up condition for several months.

The eggs of the Fruit-tree Red Spider are commonly laid on the bands, while the brick-red adults of the greenhouse Red Spider hibernate in the folds of the sacking.

Several larvæ, notably the Codlin Moth, winter in the sacking. During 1928 and in 1929 the larvæ of the Codlin Moth have been found in the bands in considerable numbers, and it is considered that this pest is increasing very considerably in this district of Kent.

Many other animals—for example, Millipedes, Centipedes, Woodlice, Spiders, the Red Velvet Mite and even earthworms—abound in the sacking, and it is to be expected that many more species will be found as time goes on.

A full list of insects recorded from the bands is appended, and it is proposed to add to the list at some future date.

The writer is greatly indebted to Mr. K. G. Blair for the determination of the Coleoptera marked with an asterisk, and to Mr. W. Steer for the determination of the Capsids.

COLEOPTERA.

CARABIDÆ.

Demetrias atricapillus, L.
Dromius linearis, Ol.
—— *meridionalis*, Dej.
Dromius quadrimaculatus, L.
—— *quadrinotatus*, Panz.

HYDROPHILIDÆ.

**Helophorus brevipalpis*, Bed., var. ?

STAPHYLINIDÆ.

Tachyporus hypnorum, F.
*—— *pusillus*, Grav.
**Quedius schatzmayri*, Grid.
**Xantholinus linearis*, Ol.
**Stilicus orbiculatus*, Pk. (*affinis*, Er.).
**Medon propinquus*, Bris.
Pæderus littoralis, Grav.
**Stenus rogeri*, Kr.
—— *atratulus*, Er.
Oxytelus rugosus, Grav.

PHALACRIDÆ.

**Olibrus æneus*, F.
**Stilbus testaceus*, Panz.

COCCINELLIDÆ.

Adalia bipunctata, L.
**Coccinella 10-punctata*, L.
11-punctata, L.
7-punctata, L.
Halyzia 22-punctata, L.
Exochomus quadripustulatus, L.
**Rhizobius litura*, F.

NITIDULIDÆ.

**Omosita colon*, L.
**Meligethes æneus*, F.

LATHRIDIIDÆ.

**Corticaria elongata*, Gyll.
**Melanophthalma gibbosa*, Hbst.

CRYPTOPHAGIDÆ.

**Micrambe vini*, Panz.
**Atomaria linearis*, Steph.

CHRYSOMELIDÆ.

**Phyllodecta laticollis*, Suffr. (*cavifrons*, Th.)
*—— *vitellinæ*, L.
**Longitarsus melanocephalus*, De G.
**Phyllotreta atra*, Payk.
—— *vittula*, Redt.
*—— *undulata*, Kuts.
Plectroscelis concinna, Marsh.

Anthicidæ.

Anthicus antherinus, L.

Curculionidæ.

Apion miniatum, Germ.
*—— *carduorum*, Kirby.
Otiorrhynchus singularis, L. (*picipes*, F.).
Phyllobius oblongus, L.
—— *maculicornis*, Germ.
Sitones lineatus, L.
**Phytonomus* (*Hypera*) *rumicis*, L.
—— (——) *nigrirostris*, F.
**Dorytomus tæniatus*, F. (*maculatus*, Marsh).
Mecinus pyraster, Herbst.
Anthonomus pedicularius, L.
—— *pomorum* (L.), Curt.
—— *rubi*, Herbst.
—— *cinctus*, Koll.
**Ceuthorrhynchus contractus*, Marsh.
**Magdalis cerasi*, L.

Capsidæ.

Lygus pratensis, L.
campestris, L. (*pastinaceæ*, Fall.).
Liocoris tripustulatus, F.
Camptobrochis lutescens, Schill.

Anthocoridæ.

Anthocoris nemorum, L.

Orthoptera.

Forficula auricularia, L.

Aphididæ.

Anuraphis roseus, Baker.

Acarina.

Oligonychus ulmi, C. L. Koch. (Eggs.)
Tetranychus telarius, L. (Adults.)
Allotrombidium fuliginosum. (Red Velvet Mite.)

Larvæ.

Cydia pomonella, L.
Porthesia similis, Fuesl.
Dasychira pudibunda, L.
Arctia caja, L.
Numerous species of Carabid larvæ.
Dipterous larvæ, mainly Syrphidæ.
Chrysopid larvæ.

Pupæ.

Pieris brassicæ, L.
Pieris rapæ, L.

Other Animals present.

Millipedes.
Centipedes.
Worms.
Woodlice.
Spiders (*Araneæ* spp.).

XXXII.—*Exotic* Muscaridæ (*Diptera*).—XXX. By J. R. Malloch, Bureau of Biological Survey, Washington, D.C.

Family **Asteiidæ.**

Genus SIGALOESSA, Loew.

Dr. O. Duda, in 1927 *, published a revision of the Asteiidæ of the Old World, and included in his key all the genera known to him. He erected one new genus for the reception of a Hungarian species, *Astiosoma*, which is apparently very close to the one now dealt with, differing essentially only in wing-characters, the alula being present, and the first vein connecting with costa beyond apex of first vein, while the apical section of fifth vein is shorter than the preapical one. In *Sigaloessa* the second vein connects with first at its apex, the fifth vein has its apical section longer than the preapical, and the alula is practically lacking.

The new species described below agrees in all essential characters of generic import with *bicolor*, Loew, the genotype, a North American species. For other characters, see species description.

It may be of interest to note that *Sigaloessa flaveola*, Coquillett, a North American species, belongs to *Astiosoma*, and agrees very closely with Duda's description of *rufifrons*, though it would be necessary to compare specimens of each to determine whether they are distinct.

Sigaloessa insularis, sp. n.

Male.—General colour testaceous-yellow, the type slightly greasy but showing the following markings: ocellar spot and four vittæ on mesonotum fuscous, the latter incomplete posteriorly, the submedian pair almost fused and shorter than the sublateral pair, the latter furcate behind the suture; a dark mark on the lower part of mesopleura, and another on lower half or more of sternopleura; the lower margin of cheek narrowly dark; abdomen without distinct dark markings; halteres brown; wings hyaline.

Head seen from above with a quite wide space between upper angle of eye and the occiput which tapers off laterally; frons slightly longer than wide, with many short dark surface-hairs, ocellars very short; outer verticals not very well developed, but longer than the short inner pair; orbits distinct,

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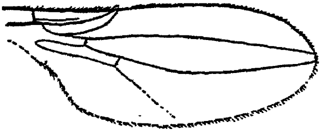
* Deutsch. Ent. Zeitschr. p. 113.

each with one bristle on the upper third; face sunken, without an evident central carina, epistome slightly projecting, the antennæ only half exposed in profile, third segment disc-like; arista pubescent; cheek not as high as width of third antennal segment; occiput hollowed out and darkened on upper half; palpi short and rather stout. Thorax with two notopleurals, two pairs of dorsocentrals, the anterior pair close to middle, one sternopleural, and two scutellars, the mesonotum with a few microscopic hairs, some of them on the anterior half of the acrostichal area. Abdomen without exceptional armature. Legs normal. Wing-venation as fig. 1.

Fig. 1.



Wing of *Sigaloessa insularis*, sp. n.

Length 1·75 mm.

Type, Papeete, Society Islands, July 1928 (*A. Tonnoir*). One specimen.

The genotype—*bicolor*, Loew—is a much darker species, having the upper half of the frons largely, and all of the mesonotum shining black, the yellow scutellum standing out in striking contrast to the latter.

I know nothing of the early stages of the species, but they occur most commonly on the inside of windows in sheds and outbuildings in North Ameria. Possibly the larvæ are fungivorous, as are most of the Drosophilidæ to which the family is most closely related.

It would appear to be pertinent to indicate at this time that my species described as *Sigaloessa melbournensis* from Australia is more properly referable to the genus *Astiosoma*, having the second wing vein distinctly separated from the apex of first at costa, and the alula more distinctly developed, while the apical section of the fifth vein is distinctly shorter than the preapical one. The subdivision of the genera of the family by Duda took place after this species was described, so that I did not entertain the above as generic characters, and, in fact, am not too deeply involved in their acceptance even at the present time. However, the alignment shows the more intimate relationships of the species and may be accepted for that reason.

Genus ASTEIA, Meigen.

Asteia striatifrons, sp. n.

Male.—Head black, frons shining, with a narrow yellow line along inner margin of each orbit on upper half which extends to vertex; face glossy, fuscous, with a slight trace of translucence causing it to appear yellowish in some lights, the lower margin not paler than the remainder of surface; antennæ testaceous-yellow, upper margin of third segment narrowly dark; labrum black. Thorax glossy black; scutellum lemon-yellow; pleura testaceous-yellow, with a black mark on upper anterior angle and a vitta over upper margin of mesopleura which connects with the dark colour of the postnotum. Abdomen shrunken in type, fuscous above, yellowish below. Legs yellow. Wings hyaline, veins dark. Halteres yellow, knobs black.

Arista with rays which are about half as long as width of third antennal segment; each orbit with a single well-developed bristle which is longer than the ocellars; the four verticals present, not very long; vibrissæ fine and of average length; cheek about as high as width of third antennal segment. Thorax with but two pairs of quite long dorsocentral bristles; scutellum with two bristles; anterior sternopleural bristles very fine and short. Legs normal. Wings long, almost identical in shape and venation with those of *sexsetosa*, Duda, according to the figure of the latter given by the describer. Halteres with rather long knobs.

Length 2 mm., wing 3 mm.

Type, Colonia Perene, Chanchamayo, Peru, 16. vii. 1928 (*R. C. Shannon*).

This species will run down to Caption 6 in Duda's key *, but it differs from both the included species in having the face fuscous, and from one or the other in colour of halteres, frons, mesonotum, and scutellum.

It is possible that, like some other species of the genus, this one has the dorsum of the abdomen maculate, but in its present condition it is impossible to determine the normal coloration or if spots are present.

Family **Drosophilidæ**.

Subfamily *CYRTONOTINÆ*.

Up to the present but one genus of this group has been recognized, and its position has been subjected to varied opinions, though it has usually been placed in, or close to,

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* Deutsch. Ent. Zeitschr. 1927, p. 128.

Drosophilidæ. In a recent shipment of material from Mr. H. M. Pendlebury of the Federated Malay States Museums I find two species belonging to an undescribed genus, and as the sender is particularly interested in ascertaining the identity of these I have resurrected some old notes of mine on *Cyrtonotum* and present below my conclusions in the hope that they may prove of interest to students of the group.

Hendel in his recently published key to the families of Diptera * ranks the group as a subfamily of Drosophilidæ, but his key-characters are drawn exclusively from *Cyrtonotum*, and the new genus described below having no forwardly directed anterior orbital bristle will not run out at the proper place in the key. The genus is undoubtedly closely related to *Cyrtonotum* despite the lack of these bristles, agreeing in all the predominant group-characters with that genus, such as the plumose arista, very convex mesonotum, bristled mesopleura, and sternopleura, lack of a cross-vein between the discal and second basal cells of the wing, lack of presutural dorsocentrals, presence of the preapical dorsal tibial bristle, discal hairs on the scutellum, and convergent postvertical bristles.

To indicate more clearly the distinctions between the two genera I present below a synopsis of their characters based upon material in my possession :—

A. Each frontal orbit with but one bristle, which is recurved; inner cross-vein distinctly proximad of level of apex of first vein; frons of male much narrowed above, at bases of the orbital bristles not over one-fourth of the head-width, frons of female not narrowed above, generally about one-third of the head-width; ocellar and postvertical bristles minute and hair-like .... *Anasieomyia*, [gen. nov.

AA. Each frontal bristle with two strong bristles, the anterior one proclinate, the posterior one reclinate, and usually a short reclinate setula close to the base of the proclinate bristle; frons of male and female equally wide, not less than one-third of the head-width, and usually much wider; ocellar and postvertical bristles long and strong .... *Cyrtonotum*, [Macquart.

Genus Cyrtonotum, Macquart.

Hendel has published a revisional paper on the South American species dealing with ten species, omitting only the North American *helvum*, Loew, of those occurring in the New World †.

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* "Die Tierwelt Deutschlands," Diptera, ii. (1928).

† Deutsch. Ent. Zeitschr. 1913, p. 618.

The following notes are presented to clear up some synonymy and extend the recorded range of some of the species :—

Cyrtonotum pantherina (Walker).

This species, as accepted by Hendel, is the same as paratype examples of *salinum*, Curran, in the collection of the United States National Museum.

Brazil and Bolivia.

Cyrtonotum gibbum (Fabricius).

This species was misidentified by Hendel, who redescribed it as *tæniatum*, sp. n.

Dr. Aldrich has identified a number of specimens from Bolivia in the collection of the United States National Museum which agree with the female type-specimen in the Copenhagen Museum which he has examined. The male type-specimen, he states, does not appear to be the same species, having two sternopleural bristles and differing in other respects. Hendel's description of *tæniatum* is a very good one of this species, the frontal markings being very characteristic with the whitish-dusted central vitta laterally margined with dark chocolate, which develops into a pair of blackish spots on anterior margin as noted in Wiedemann's description of *gibbum*.

Cyrtonotum hendeli, nom. nov.

This name is proposed as a substitute for *gibbum*, Hendel *, not Fabricius. There are a number of specimens of the species in the United States National Museum.

Cyrtonotum bathymedum, Hendel.

One specimen of this well-marked species, originally described from Peru, in the United States National Museum.

Locality.—Rurrenabaque, Rio Beni, Bolivia, December (*W. M. Mann*, Mulford Exped.).

Cyrtonotum striatifrons, sp. n.

Female.—Head testaceous-yellow, a narrow line along each side of frons, the face, cheeks, and postocular orbits, whitish-dusted, frons with a pale brown vitta on each side of the ocellar region extending to anterior margin and dividing the front into three almost equally wide pale stripes ; orbital stripes yellowish-grey dusted, not extending to middle of frons; antennæ and palpi testaceous-yellow. Thorax coloured as head, pleuræ paler than mesonotum, the latter with four narrow, complete, yellowish-brown vittæ, the sublateral pair slightly broken at suture and situated a little laterad of the dorsocentrals. Abdomen testaceous-yellow, tergites quite densely grey-dusted, tergites 2 to 4 inclusive each with a linear central blackish vitta and a pair of small lateral blackish spots on dorsum which are sometimes carried more or less noticeably forward on some of the tergites. Legs pale stramineous. Wings greyish hyaline, outer cross-vein narrowly clouded with pale brown, and a very faint trace of clouding along the third and fourth veins apically. Squamæ and halteres testaceous.

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* Deutsch. Ent. Zeitschr. 1913, p. 624.

Frons half of the head-width, parallel-sided, and slightly longer than wide, the face slightly narrowed below; all four verticals, the postverticals, ocellars, and the proclinate and upper reclinate orbitals, long and strong, the small anterior reclinate very short and fine, proclinate orbital not over one-third of the length of frons from vertex, surface-hairs lacking; face slightly convex, width of the three parts at middle practically equal; vibrissæ small and fine; arista with about thirteen long hairs above and five below. Thorax with the usual bristling, a second short sternopleural present above the strong one. Abdomen without strong apical bristles on the tergites; genitalia without apical thorns. Fore femur with the anteroventral comb on apical half consisting of much finer and more closely placed black setulæ than usual. Inner cross-vein of the wing very slightly beyond level of apex of first vein; costa with about six quite long bristles on the under side beyond apex of first vein, its section between third and fourth veins faint but evident; ultimate section of fourth vein slightly divergent apically.

Length 9 mm.

Type, and one paratype, Bahr el Ghazal, 14. vi. 1922, No. 14165, W. T. R. L. (*Capt. Boutdillon*).

Returned to Imperial Bureau of Entomology.

Cyrtonotum magnum, sp. n.

Female.—Head reddish brown, frons darker centrally, with grey dust on vertex, orbital stripes, and narrowly along eye-margin on entire length; face black in centre, with grey dust, parafacials darkened below in certain lights, with yellowish dust; antennæ reddish, third segment largely blackened; palpi fuscous. Thorax fuscous, the entire surface with dense grey dust, mesonotum with four narrow dark brown vittæ behind the suture, and dark brown dots at bases of the hairs and bristles; mesopleura with dark brown dots at bases of the hairs and bristles; scutellum with a pair of brown vittæ which converge at apex and brown dots at bases of the hairs and bristles. Abdomen coloured as thorax, but with the dust paler grey, no dark setiferous dots, and black-brown apices to the tergites, which do not extend to extreme lateral edges, and connect on the second to fourth tergites with a central vitta of same colour. Legs tawny yellow. Wings yellowish, with a brown costal stripe which extends over midway to third vein on section beyond apex of first vein, and narrow margins of same colour on the other veins and outer cross-vein.

All four verticals, the postverticals, ocellars, proclinate and upper reclinate orbital, very long and strong, anterior reclinate short, proclinate orbital rather close to upper reclinate and nearer to eye than it, situated about two-fifths of the distance from upper margin of frons to anterior margin of same; face foveolate; upper postocular setulæ long and strong. Thorax with two pairs of postsutural dorsocentrals and one pair of prescutellar acrostichals, two strong sternopleurals, four strong and a number of much weaker scutellar bristles; propleural present. Abdomen with some rather short apical tergal bristles; the genital processes slender and unarmed. Fore femoral anteroventral comb rather widely spaced. Costal spines long; first posterior cell not narrowed at apex.

Length 10 mm.

Type, Alto Itatlaya, Serra do Itatlaya, S.E. Brazil, Feb. 21, 1922, 7150 feet (*E. G. Holt*).

The largest species known to me.

Cyrtonotum anus (Meigen).

This European species is apparently represented by four examples in my African material, but having no authentic European examples I list some of the characters of the species before me so that the identification may be checked. In colour the specimens agree with the description of *perrisi*, Schiner, except that there is a spur of the dark colour on the lateral curve of each tergite running forward to, or almost to, the anterior margin of the tergites and there is a small dark mark on the extreme lateral margin of the tergites. The sternopleura has one strong bristle and above it a rather long setula, the fore femur has a sparse anteroventral comb on the apical half, the costal vein is practically obsolete beyond the apex of third vein, and the costal bristles are quite long. The proclinate orbital bristle is situated not over one-third from anterior margin of frons, in line with the posterior reclinate one and not one-third as long as the latter which is situated close to middle of frons, the anterior reclinate bristle is minute, and the face is shallowly foveolate on each side.

Length 5 mm.

Locality.—Lomagundi, S. Rhodesia, vi.–vii. 1929, No. 2288, Dept. Agric. (*A. Cuthbertson*). A pair taken *in copula*.

This species was not recorded by Bezzi in his large paper on the Diptera of Eritrea, though he included three other species, none of them known to me.

Genus ANASEIOMYIA, nov.

This genus has the same hump-backed appearance as *Cyrtonotum*, but the head is very different in structure in both sexes from that of any species of that genus, the latter all, so far as I am aware, having the frons about equally wide in male and female. The general characters of the head in the sexes may be gleaned from figs. 2 & 3. The wings lack the costal spines, have the apices more pointed than is usual in *Cyrtonotum*, and the inner cross-vein is much farther proximad of the level of apex of first vein than is the case in any species of the other genus known to me, only *anus* of those before me now having it proximad of the apex of first and that but slightly so.

Genotype, *Anaseiomyia uniformis*, sp. n.

I have before me two species, but have the male only of one and both sexes of the other. They may be distinguished as below.

Key to the Species.

A. Thoracic dorsum in both sexes with whitish-grey dust and four broad chocolate-brown vittæ which obliterate almost all of the pale dust except a narrow line between each posteriorly and extend almost the entire length of mesonotum in the female, but are much shortened anteriorly in the male, only the central three extending to or slightly proximad of the suture; abdominal tergites 2 to 5 similarly marked on dorsal exposure, with a broad chocolate-brown posterior margin which sends three branches to anterior margin, the central one regular in shape, the one on each side irregular in outline .... *uniformis*, sp. n.

AA. Thoracic dorsum densely whitish-grey dusted, with a broad chocolate-brown mark on posterior margin which extends to short of the anterior one of the prescutellar pairs of dorsocentral bristles and is slightly tridentate on its anterior outline; abdominal tergites 2 to 5 dissimilarly marked, second and fourth each with an irregular posterior margin of chocolate-brown and a somewhat similar anterior margin which sends two branches backward centrally to connect with the posterior one, the third and fifth tergites each with only the posterior dark border, the anterior margin grey-dusted and usually without any dark marks .... *dissimilis*, sp. n.

Fig. 2.

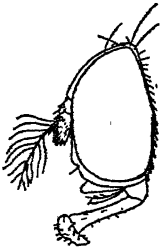

Fig. 3.

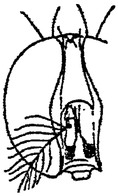

Fig. 2.—Head of *Anaseiomyia uniformis*, sp. n., from the side.
Fig. 3.—Head of *Anaseiomyia uniformis*, sp. n. (partial), from in front.

Anaseiomyia uniformis, sp. n.

Male and Female.—Head fuscous, with silvery-white dust; seen from behind the frons of the female is dark brown, with a central line and very narrow orbits silvery-white dusted, that of the male is silvery white when seen from behind and above, but from in front the silvery dust is confined to the orbits and the interfrontalia is dark brown; antennæ and palpi fuscous. Thorax densely whitish-grey dusted, vittate as noted in the foregoing synopsis; scutellum dark brown usually with a very small central apical mark white-dusted; postscutellum and central portion of metanotum dark brown. Abdomen silvery grey with dark brown markings, as listed in the key. Wings entirely colourless and glossy. Legs testaceous-yellow, apices of femora infuscated, most noticeably so above. Knobs of halteres yellow.

Head in profile as fig. 2 in male, very similar in female; anterior view in male as fig. 3, the frons in female one-third of the head-width, parallel-sided, face equally wide above, very slightly narrowing below, the central carina not very strongly developed; vibrissæ very small. Thorax with two pairs of postsutural dorsocentrals and one pair of prescutellar acrostichals, the intradorsocentral setulæ in eight series posteriorly; sternopleural one, mesopleurals two, humerals two, the lower one directed downward and outward; scutellum with numerous discal setulæ and four marginal bristles, the apical pair shorter than the others. Abdomen slender, the tergites with sparse apical bristles and numerous discal hairs, first four visible tergites subequal in length. Legs slender, fore femur with an anteroventral comb on apical half; all tibiæ with short preapical dorsal bristle, mid-pair with a pair of apical ventral bristles; mid-femur in both sexes with above five curled bristly hairs at apex of postero-ventral edge, one of them stronger than the others; mid-tibia of male without outstanding hairs on any surface. Wings slightly pointed, costa distinct to apex of fourth vein.

Length 3·5–4·5 mm.

Type, male, allotype, and one paratype, Selangor, Kuala Lumpur, F.M.S., 15.xii.1927; paratypes: same locality, Wild Hill Forest Reserve, 8.x.1922; 21st mile, Gumbak Valley, 15.x.1921; 17th mile, Kanching, 22.x.1922; and 21.vii.1929, 15.xi.1929; Bukit Kutu, 500–1000 feet, 12.iv.1926; Kuala Teku, 500 feet, in Beluka, 4.xii.1921 (*H. M. Pendlebury*).

The collector was anxious to have the identity of this fly and the next one established because of the peculiar habit of the species in rising, when disturbed, into the air almost straight up and then coming back to rest upon the same leaf. I have no record of this habit in any species, though many specimens, especially of Syrphidæ, will repeatedly come back to alight upon the same exposed leaf or twig after longer or shorter flights, and may readily be captured if this habit is considered. However, the straight up and down habit of flight of the species when disturbed is unique, so far as I know. Any specimens of *Cyrtonotum* that I have taken have been by sweeping and I know nothing of their habits of flight.

Anaseiomyia dissimilis, sp. n.

Male.—Very similar to the preceding species, but the sharper line of demarcation between the anterior margin of the chocolate-brown posterior mesonotal marks and the white-grey dust of the thorax, and their reduction, as well as the distinction in the abdominal markings readily distinguishes it.

Structurally similar to *uniformis*, but the mid-tibia of the male has a series of rather outstanding setulose hairs on the basal half or more of the anterodorsal surface, and the intradorsocentral hairs on the mesonotum are, though in eight series, much more regularly arranged because of their not being on the edges and centre of the dark vittæ.

Length 3·5–4·5 mm.

Type, Selangor, Kuala Lumpur, 15.xii.1929; paratypes, same locality, 11.iv.1926, 4 and 26.vi.1921, and 21.vii.1929; Kuala Teku, 550 feet, in clearing in jungle, 7.xii.1921 (*H. M. Pendlebury*). Six specimens.

I note also the presence of a female taken on same date as one of the recorded males, which, though in rather poor condition because of grease, appears to belong to this species. It is similar to the female of the first-described species, but the mid-tibia has a series of short, but rather outstanding, setulose hairs on the basal half of the anterodorsal surface.

I place it tentatively as the allotype.

Locality, Kuala Lumpur, 25.vi.1921 (*H. M. Pendlebury*).

Type-specimens of both species to be deposited in the British Museum.

Although Mr. Pendlebury stated in his letter that he was sending "a" species both were standing in series indiscriminately, and I assume that the peculiar habit of flight referred to under the preceding species is adopted by this one also.

Subfamily *DROSOPHILINÆ.*

I have a very large number of species of this subfamily in my hands from many parts of the Old World, but am working most of them up in connection with various faunal papers, especially those of New Zealand and the Samoan Islands. In the present paper I deal with only one species and that only to clear up any possibility of misidentifications should the species be found in other collections, as it very closely resembles one that is quite widely distributed in the Orient and the Pacific Islands.

Genus MYCODROSOPHILA, Oldenburg.

Mycodrosophila halterata, sp. n.

Female.—Head fuscous (greasy in type), but the face, cheeks, and lower occiput showing yellowish; antennæ brownish; labrum and palpi fuscous. Thorax glossy black on dorsum, pleura pale yellow except on upper anterior margin where it is dull black, scutellum dull black and with brownish dust when seen from certain angles, apical margin shining. Abdomen testaceous-yellow, with an interrupted central black vitta, and a transverse black mark on apex of visible tergites 1 to 4 inclusive which is almost complete on the first two tergites and distinctly separated from the central spot on the others. Legs yellow. Wings hyaline, with the usual deep black mark on costa at apex of first vein. Halteres yellow, knobs not at all blackened.

Structurally similar to *gratiosa*, de Meijere, but rather larger. Mesonotum with but one pair of dorsocentral bristles; the two humeral bristles small; sternopleurals two; scutellum with the basal pairs of bristles over half as long as the apical pair. Legs slender, without abnormal armature. First posterior cell slightly narrowed apically; outer cross-vein at about 1·5 its own length from apex of fifth vein; ultimate section of fourth vein about 2·25 as long as penultimate section.

Length 2·25 mm.

Type, Matæia, Society Islands, August 1928 (*A. Tonnoir*).

This species resembles *gratiosa*, de Meijere, very closely, differing essentially in having the abdomen differently marked, the halteres with yellow knobs, and in some other characters. From *argentifrons*, Malloch, described from Australia, it differs also in the colour of the halteres, and in having the mesonotum entirely shining black, as well as in the markings of the abdomen, the Australian species having an anterior marginal dark fascia on each tergite. Duda's two species, *ciliatipes* and *biroi*, described from Singapore, have black knobs to the halteres, and the first-named has the pleura vittate with black.

Family Muscidæ.

Subfamily *PHAONIINÆ*.

Genus XENOSINA, Malloch.

This is the second additional species which I have described since my key to the species of the genus appeared in 1925 *.

I have another new species before me, which I am describing in another paper, also including a revised key to the entire genus.

Xenosina setipennis, sp. n.

Female.—Head black, frontal orbits and face with yellowish-white dust; antennæ and palpi blackish brown. Thorax testaceous-yellow, variably darkened on pleura and largely fuscous on dorsum, with distinct grey dusting, the dorsum with the usual four black vittæ, the submedian pair complete; scutellum testaceous-yellow. Abdomen black, shining and almost without dust on the tergites, except the fourth visible which is rather densely pale grey dusted. Legs testaceous-yellow, fore coxæ in front and all tarsi fuscous. Wings yellowish hyaline, veins at bases, calyptræ, and halteres yellow.

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* Phil. Journ. Sci. vol. xxvi. No. 4, p. 507.

Frons at vertex about one-third as wide as one eye; ocellars and all four vertical bristles strong; parafacials almost invisible in profile; cheek not so high as the width of third antennal segment. Thorax with the usual bristling, all four pairs of postsutural dorsocentrals strong, sternopleurals 1 + 2; sides of scutellum with rather strong black hairs below the marginal bristles. Abdomen stout, third visible tergite with the apical transverse series of bristles a little stronger than the discal series on fourth tergite and much stronger than the apical series on same. First wing-vein with setulæ on entire length above, third with setulæ above to, or beyond, middle of its apical section, and to inner cross-vein below, fourth vein with some setulæ on apical half of discal cell above; fourth vein distinctly bent forward at apex.

Length 8 mm.

Type, Kedah Peak, Malay Peninsula, 3000 feet, 18.iii. 1928 (*H. M. Pendlebury*). Federated Malay States Museums.

This specimen is the only one of the genus in which I have observed setulæ on the fourth vein. The character may not be normal.

Family Tachinidæ.

Tribe ACTIINI.

Genus ACTIA, Robineau-Desvoidy.

I have at the present time in the press, in the 'Journal of the Federated Malay States Museums,' a review of the species received from Mr. H. M. Pendlebury and one or two other correspondents in that region, and having recently received some additional material belonging to the genus containing a new species, I give below a description of it to make my review of the genus from the region as complete as possible.

Actia perdita, sp. n.

Male.—Black, distinctly shining, very similar to *frontalis*, Macquart. Head with dense whitish-grey dust except on the interfrontalia, the latter reddish; basal two segments of antennæ reddish, third and aristæ black; palpi clay-yellow. Thorax with quite dense and even grey dust on dorsum, without vittæ, the scutellum less densely grey-dusted. Abdomen glossy black, each tergite with a pale grey anterior fascia, usually more or less noticeably interrupted in centre. Legs black, apices of fore femora and entire fore tibiæ brownish. Wings hyaline. Calyptræ greyish, lower one slightly browned in centre. Halteres yellow.

Frons at vertex slightly less than one-third of the head-width, widened anteriorly, each orbit with two outer proclinate bristles, the surface-hairs few and fine; third antennal segment not wider than usual, about three times as long as second; arista almost bare, second segment about three times as long as thick; cheek about as high as width of third antennal segment; one or two fine setulæ above the vibrissæ; palpi normal; proboscis about as long as head. Thorax with three pairs of postsutural dorsocentrals; the lower stigmatal minute. Abdomen without apical bristles on first visible tergite, with a pair on third; hypopygial forceps not very long, but quite slender. Ventral bristle on mid-tibia rather small. Fourth vein lacking from preapical bend; first setulose on apical third above, third setulose above to about level of outer cross-vein; ultimate section of fifth vein but little shorter than penultimate, third vein ending with costa in apex of wing.

Length 2·5 mm.

Type and one paratype, Selangor, Bukit Kutu, F.M.S., 3500 feet, 7.ix. 1929 (*H. M. Pendlebury*).

Type to be deposited in the British Museum.

This species is very similar in most respects to *frontalis*, Macquart, but the latter has the first, third, and fifth wing-veins setulose above.

XXXIII.—*Notes on the Biology of Spiders.*—I. *The Evolution of Spiders' Snares.* By W. S. Bristowe, B.A., F.Z.S.

The three most important influences in the life of a spider are reproduction, food, and protection. There are a number of different types of snare, and in some one of these influences prevails, in others another. Thus, the Trap-door nests afford splendid protection against enemies and adverse climatic conditions, the beautiful orb-webs of Epeirids represent the most efficient means of capturing prey, whilst silk was almost certainly evolved and used for the manufacture of egg-coverings in the first instance.

Several spider experts have attempted to trace the course of the evolution of the different kinds of snare, but there is, I think, one point which they have all failed to take into consideration, and which is of fundamental importance for a clear and simple understanding of the relationship of the different kinds of snare. I refer to the position of the spider in the snare, whether inverted or erect. Is it just chance that some builders of sheet-webs like the Linyphiidæ and Psechridæ are inverted and run about on the underside of the web, whilst others, such as the Agelenidæ, Dipluridæ, and Hippasinæ, are erect, and catch their prey on the upper surface? I am going to suggest that it is not, and that, although all these webs probably have been evolved independently, there have been two main lines of evolution—one for the sheet-webs in which the owners are inverted and another for the sheet-webs in which they are erect.

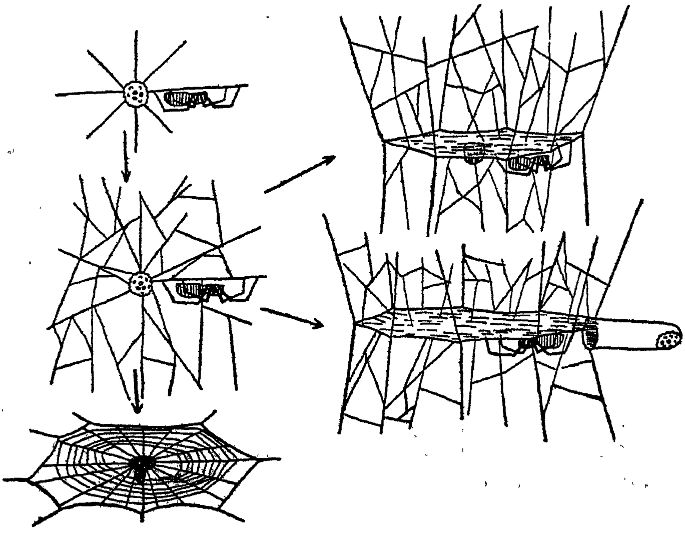
It is admitted that the earliest spiders were wanderers, and it is probable that silk was first used for the protection of their eggs. This seems likely in view of the fact that all spiders use silk for this purpose, and that other Arachnids have evolved silk organs not homologous to those of spiders for the sole purpose of protecting their eggs. Originally spider-silk was, in all probability, of an excretory nature, the product being smeared over the eggs, and later, as its consistency changed, drawn out into threads. When the eggs are laid, the spider—in all the primitive families, and in most other families as well—sits by them until they are hatched and the young scattered. She drives away large intruders with considerable bravery, and catches for food any which are of a suitable size. She is aware of their presence directly they touch one of the strands of her cocoon, if not before; but spiders are for the most part very short-sighted, so the occurrence of additional strands of silk round the cocoon would be an advantage not only in serving to entangle the feet of insects, but also in extending her hunting field. To begin with, these strands were undoubtedly fortuitous, and the outcome perhaps of the drag-line, which was evolved early in their history and which most living spiders trail whenever they walk. So far, our reasoning will apply in all essential respects to both lines of evolution with which I am proposing to deal, in that the egg-cocoon was the central point on which the snares were based.

1. *The Evolution of Webs in which the Spiders are inverted.*

It stands to reason that the primitive web formed of haphazard strands crossing one another at all angles should radiate outwards in all directions from the egg-cocoon. This kind of web is found in the families Theridiidæ and Pholcidæ. *Pholcus* sits in the centre of its web with its eggs, and many species of *Theridion* do likewise, although these latter spiders usually build a little silken tent or else utilise some foreign body, such as a piece of leaf, for cover and protection. The logical stance for spiders in webs of this sort is an inverted one, as they would otherwise have to balance themselves on single threads like a man walking a "tight-rope." In course of time, some resorted to the added protection of chinks in the bark of trees, cracks in rocks, etc., and, as they still retained the instinct of guarding over their eggs, these were deposited there also. Some of the Theridiids have adopted this mode of living (e. g., *Steatoda*, *Lithyphantes*, etc.). In running out to capture insects these spiders, by reason of their drag-line and their inverted position, would be inclined to thicken the snare above them, and, near the entrance to their retreat, from which they would diverge in the direction of the insect, a flimsy sheet would be formed automatically in course of time. This happens in actual practice, and I recently noticed it to quite a marked extent in the webs of the southern European Theridiid, *Lithyphantes paykullianus*. This represents a link between the ordinary *Theridion* web and the sheet web such as is built by the Psechrids of Tropical countries. These spiders build a coarse sheet with a retreat leading into a hole in a bank or tree. Now, for a sheet to be formed, it is not essential that there should be any such retreat, for the act of walking about in the centre of the web would similarly produce a platform of silk, and it is significant that in spiders of the genus *Linyphia* there is such a platform or sheet with irregular strands of the Theridiid type *above* and *below* it. In some other spiders of the same family the irregular strands have been dispensed with. This not only effects an economy of silk and effort, but also represents an adaptation to environment, for these Linyphiids live close to the ground and span irregularities in it such as are formed by horses' hoofs. The habit of securing the egg-cocoons to the centre of the web (*Tapinopa* etc.) further supports the views expressed above as to the evolution of their webs.

We have explained the course of evolution of sheet webs, where the spider is inverted, but to complete our considerations in this section we must turn our attention to the wonderful orb-webs of the Epeirids and Uloborids. Let us return to the early Theridiid stage, where haphazard threads surrounded the egg-cocoon. Some sort of symmetry is to be expected, where the eggs are retained in the centre, as there is no reason why the web should extend in one direction more than another. The use of viscid silk in snare-making—used only for entangling insects by the Theridiids after they are caught—called for some modification in snare-structure. The Epeirid never becomes seriously entangled in its own web owing to the development of oil-glands, but with a thick web of gummy threads its progress and activities would be impeded, so an open-work web radiating out from the centre, where the eggs were kept, was eventually evolved. This had the advantage of economy, which was important, since the gummy portions would only remain gummy for one day, and it also enabled the spider to slip through the meshes from one side to the other,

Fig. 1.



The evolution of the Linyphiid, Psechrid, and Epeirid types of web from the Theridiid type.

thereby enabling it to deal more effectively with the insects that were caught. I have pointed out above that the web would naturally radiate out roughly from the centre, where the eggs were situated, and the accurate symmetry of the webs with which we are accustomed to-day is achieved with the aid of the front legs, which are used as measuring instruments. Dr. Hingston has shown that the loss of the front legs results in these accurate orb-snares losing their symmetry in the following words from his book, 'A Naturalist in Himalaya,' 1920, p. 106:—"No one who has contemplated the mathematical accuracy of a circular snare could have looked with indifference on its tangled texture. Its radial and parallel beauty was lost; threads in confusion adhered to one another; triangles, quadrilaterals of every shape replaced the perfect symmetry of its parallelograms; spirals crossed other spirals. . . ."

Perhaps the majority of Epeirids have taken to living in retreats away from the web, but those of the genus *Cyclosa* live in the centre of their snares and place their egg-cocoons there. This is also the case in *Uloborus*, whose web, in my opinion, though very similar to that of *Epeira*, may well have been evolved independently. In *Uloborus* and *Epeira dromedaria* the webs are horizontal, but in the majority of orb-weavers it has become inclined or vertical. In this position it is more likely to entrap the flying insects on which these spiders depend. Epeirid spiders of the genus *Cyrtophora* are interesting in that their webs closely resemble those of *Linyphia*, as they consist of a platform amidst a network of haphazard threads above and below of the Theridiid type. In this genus the egg-cocoons are retained in the centre of the web.

2. *The Evolution of Webs in which the Spiders are erect.*

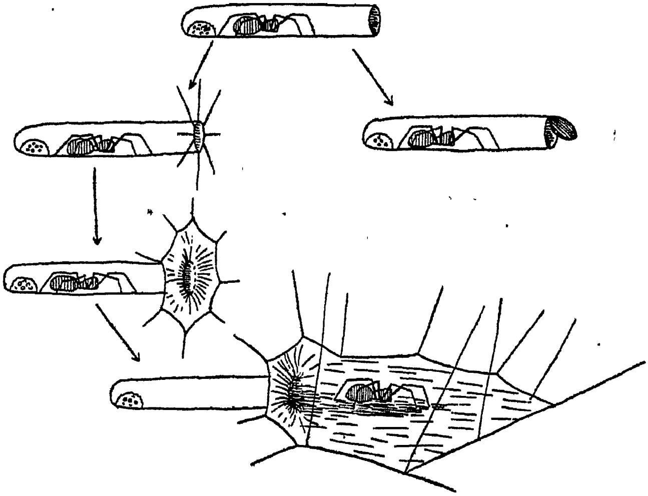
Here, again, I believe that similar results have been arrived at quite independently by passing through similar stages of evolution, so the names of different spiders are brought in simply to illustrate types of snare, and not with the idea of suggesting one direct line of descent.

Many of the wandering spiders took refuge under stones, in holes in the ground, etc., and when it came to egg-laying these were deposited there. According to the usual practice, the spider remained with them, and pounced out on anything that "darkened her doorway." Here, again, it would increase the spider's hunting-field if a few strands of silk radiated outwards from her retreat, and these were no doubt provided accidentally at first, probably through the drag-line habit. Some Lycosid and Mygalomorph spiders live in holes with no surrounding threads, but the former are long-sighted, whilst the latter wander forth at night in search of prey. *Segestria,* on the other hand, has a few threads radiating outwards, and if an insect touches any of these the spider is immediately aware of the fact and comes rushing out to seize it. By degrees, probably through the instrumentality of the drag-line, a kind of funnel was formed round the entrance to the spider's retreat. This form is found in *Cœlotes,* and *Amaurobius* represents an extension of this. As wanderers, in so far as they left their retreats at all, these spiders obviously retained their erect position. So far the development was quite simple—just the extension of haphazard threads equally all round the retreat, but to a spider frequenting slanting or vertical surfaces such as banks this was not altogether satisfactory. It necessitated the spider running up and down sharp slopes. Consequently, it was more convenient for the funnel to be asymmetrical and for the entrance on to it to come from the side. In this way a sheet-web of the house-spider (*Tegenaria*) variety came to be evolved.

I have stressed above the evolution of these webs from the custom of hiding in holes or making burrows, and I must include in this category the spiders which form silken cells above or below ground to protect themselves, in the first instance, no doubt, whilst they were guarding their eggs. Some spiders to-day only form such cells at the egg-laying period, others live in them during (*a*) the day or (*b*) the night, according as they are (*a*) nocturnal or (*b*) diurnal in habits. In some cases this cell-forming practice undoubtedly led on to the tube- or burrow-forming habit. Thus in the family Dysderidæ we find that *Dysdera* lives in a cell during the day; that *Ariadne spinipes* lives in an elongated cell with a little collar round an exit through which it can emerge to capture passing prey; and that an American relation, *A. bicolor*, makes a definite tube with strands radiating outwards from its mouth. Here we have got back to the same point from which sheet-webs arose.

That the sheet-web has been arrived at independently by different families is made clear by a study of various families or groups of families. First, let us take the family Lycosidæ. In the subfamily Pardosinæ the spiders are wanderers, and the eggs are carried about in a cocoon fastened to the mother's abdomen. In the subfamily Lycosinæ some make holes in the ground in which to place their egg-cocoons, whilst others live almost exclusively in burrows lined with silk (*Lycosa*). *Pirata piscatoria,* Clerck, instead of making a burrow, builds a vertical silken tube amongst damp moss above water. This is open at both ends and the upper end is extended into a small funnel. In Brazil, at San Paulo, I found a *Pirata* with a web similar to that of *P. piscatoria*, with the funnel extended into a small web surrounding the tube. A third subfamily, Hippasinæ, includes the genera *Porrima* and *Hippasa* which I have met with in Brazil and India respectively. These spiders build webs identical with those of our *Tegenariæ*—sheet-webs with tubular retreats at the side leading into holes in banks or under stones. That these spiders were descended from wandering ancestors is borne out by their habit of attaching their egg-cocoons to the tip of their abdomens, as in the Pardosinæ, and rushing forth to capture prey with them so attached.

Fig. 2.



The evolution of the *Tegenaria* type of web through the *Lycosa*, *Segestria*, and *Cœlotes* types. Also the evolution of the Trap-door type from the plain *Lycosa* type of burrow.

Identical stages of web-development are to be found amongst the Mygalomorphæ. There are wanderers which hide during the day. There are burrowers which have fixed abodes (1) without and (2) with a few strands of silk forming a funnel round the entrance to their burrows. And, finally, there are the Dipluridæ, which I have had an opportunity of watching in Brazil, which build webs identical with those of the Hippasinæ and Agelenidæ.

I must complete these notes by referring to the wonderful trap-doors that some spiders construct to close their burrows, and which represent a different line of evolution. These are found reaching various degrees of excellence in several unrelated families, so the assumption is that they have been independently evolved. Many spiders construct burrows and these often have no covering, with the result that rain and enemies can enter and wind can blow in sand or earth. Various devices are used to remedy these disadvantages, which give us the key to the evolution of the hinged doors. In the Mygalomorphæ some species have no fixed abode, whilst others dig burrows with unprotected entrances. *Atypus* lines its burrow with silk and extends its silken tube above the surface of the ground. This is always closed, and insects are caught through the silk and the rent repaired afterwards. In Brazil I came across a Ctenizid of the genus *Rachias*, which erects a kind of miniature mole-hill over the entrance with the earth that it excavates, and when the weather is not inclement no sign of the burrow exists. This blocking of the entrance, no doubt, led, through a silken layer across the entrance to prevent the covering earth falling in, to the formation of a kind of rude flap, through which the spider forced its way when it wanted to emerge. From this flap stage it is not a big step to the thin wafer doors of some Ctenizids. As a later development the doors were strengthened until they fitted like a cork into the entrance of the burrow. The spider will hold the door against enemies, but in spite of this some of them fall as prey to Fossorial Wasps. In Brazil I found that this was so in the case of an *Idiops*, whilst another species of similar size, *Actinopus crassipes*, Keys., built two doors, the second a few inches down the burrow, presumably to be used in cases of emergency *.

It has recently been found that that rare and primitive spider *Liphistius*, which is placed in a separate suborder Liphistiomorphæ, constructs burrows closed by a wafer trap-door †.

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* W. S. Bristowe, Trans. Ent. Soc., Feb. 1925, p. 475.

† H. C. Abraham, Proc. Zool. Soc. 1923, p. 769.

A study of the Lycosidæ, which belong to the third and last suborder Arachnomorphæ, supports the simple explanation as to the origin of Trap-doors given above for the Mygalomorphæ. As in that suborder we have (1) wanderers (*Pardosa* etc.), (2) builders of burrows with open mouths (*Lycosa* etc.), (3) species which cover their burrows with silk and earth during the winter or when the climate is not to their liking (*Lycosa* etc.), and (4) species which construct a flap or door to cover the entrance (*Lycosa aspersa, Lycosa opifex*). The habits of the N. American *L. aspersa,* Hentz (=*L. tigrina*, McCook), are described by McCook * and those of the Russian *L. opifex* by Pocock †. In the former the door is a kind of flap, in the latter the hinge is relatively weak, but the free margin of the door opposite the hinge is heavy, which results in its closing by its own weight. In the Mygalomorphæ the same effect is achieved by the strong and elastic silken hinge being spun in such a way that it snaps shut of its own accord.

Lastly, I must refer to an Indian Trap-door forming Zodariid which Mr. Graveley brought to my attention near Madras. Although the doors here have been evolved from a cell-forming and not from a burrow-constructing spider, the actual manner in which they were evolved is no doubt similar. The spider lives in an earthy cell, the ends of which are both provided with Trap-doors, of the same thickness as the rest of the cell. Some cell-makers later developed into tube-builders, as I have shown above, but this one has perfected its cell and eliminated the necessity for constant repair work. It is perhaps worthy of note that the hinges to the doors are at the bottom as opposed to a Barychelid Mygalomorph spider, *Sason cinctipes*, which builds a somewhat similar nest in the same district with the hinges above.

Literature dealing with the evolution of snares to which I have not referred in the course of this paper include the following:—

C. McCook. 'American Spiders and their Spinning Work,' vol. i.

J. H. Comstock. "The Evolution of the Webs of Spiders." Ann. Ent. Soc. Am. 1912.

W. Falconer. "The Evolution and Survival of the Spider." 'Naturalist,' Jan. 1928.

T. Savory. "The Biology of Spiders." Sidgwick and Jackson.

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* H. C. McCook, Nat. Sci. Phil. 1888, p. 193.

† R. I. Pocock, Encycl. Britannica, 11th ed., "Spiders.

XXXIV.—*Notes on the Biology of Spiders.*—II. *Aquatic Spiders.* By W. S. Bristowe, B.A., F.Z.S.

Spiders of several different families have independently taken to an aquatic or semi-aquatic life. It is not difficult to see how this has come about. Many kinds like living near water, and, with the rise of the tide or of floods, they will either be swept away and perhaps drowned, or they will take refuge in chinks in rocks etc., where a little pocket of air is captured, or they will clamber up plants or other supports until these too are submerged. A simple experiment will show that most spiders—all those with hairy bodies—will automatically entrap a bubble of air round their bodies if they are forced beneath the surface, and I have shown elsewhere that this will enable them to live quite comfortably for varying periods up to several hours *. *Lycosa purbeckensis*, F. Camb., is able to survive especially high tides which cover the mud-flats on which it lives in this manner *. The Linyphiidæ, on the other hand, have shiny hairless bodies, and such species as *Halorates reprobus*, Camb., *Erigone dentipalpis*, Wid., and other species of *Erigone* which live amongst seaweed on the shore or on mud-flats take refuge in crevices, under stones, etc. In South Africa an allied species, *Erigonopsis littoralis*, Hew., behaves in a similar manner and retires into the interstices of marine annelid tubes †. The family Agelenidæ includes *Argyroneta aquatica*, Latr. (the Water Spider of Europe), and marine spiders of the genera *Desidiodopsis* and *Desis* which are known from rocks and coral reefs exposed to the air at low tide in Malaya, New Guinea, Samoa, the Barrier Reef, the Chatham Islands, Australia, New Zealand, Zanzibar, South Africa, and the Galapagos Islands. J. Hewitt has described a fourth genus of water-spider belonging to this family from Cape Town, where it inhabits interstices in the tubes of marine annelids. It is allied to *Cicurina* and called *Muizenbergia abrahami*, Hew.

I have mentioned one representative of the family Lycosidæ which does not object to submersion—*Lycosa purbeckensis*. Other members of the family such as *Trochosa terricola*, Thor., various *Lycosæ*, and all the *Piratæ* will run down plants beneath the surface by way of escape. In the family Pisauridæ a similar habit is found, and it is said that some will dive down in search of prey. A South African species, *Thalassius spenceri*, is said to catch tadpoles, frogs, and fish four times its own weight*. Our British *Dolomedes fimbriatus*, Latr., will run down plants beneath the surface like the Lycosids, but none, except perhaps *Argyroneta*, appear to be capable of submerging themselves without the assistance of something to hold on to and walk down. *Argyroneta* is the only one which comes to the surface to renew its air-supply and which spends its whole life under water, except when it is young and migrates.

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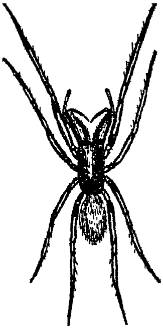
* W. S. Bristowe, "A British Semi-marine Spider," Ann. & Mag. Nat. Hist., July 1923.

† J. Hewitt, Ann. Nat. Mus. vol. iii. (1915).

Fig. 1.



Desis martensi, L. K., from Singapore.

In my paper, to which I have already referred, I mentioned another marine spider of the genus *Amaurobioides*, and assigned it to the family Dictynidæ. This genus, which is a synonym of *Uliodon*, should, I think, be included in the family Cteniæ as Petrunkevitch suggests. It appears to be restricted to Australia and New Zealand.

In a paper on "The Spiders and Harvestmen of Wicken Fen"†, I said: "On disturbing another *Epeira cornuta*, Clerck, it ran down a reed on which it had been sitting and deliberately walked down beneath the surface of the water. Here it stayed for fully a minute before turning round and climbing up again. So far as I know, this is the first time an Epeirid has been observed submerging itself." Dr. E. Nielsen wrote to me from Denmark (Feb. 1927) to tell me that he had previously noticed this very same habit of *Epeira cornuta* when disturbed, and I find there is a still earlier record of an identical observation made by Prof. Lloyd Morgan in 1893[*]. Dr. Nielsen adds that sometimes, when disturbed, they will fall by a thread with sufficient force to break the surface of the water, and that they will then hang free in the water, sometimes lying at the bottom, and then climb back to their retreat when danger is passed.

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* 'Nature,' vol. xci. p. 136 (1913).

† 'The Natural History of Wicken Fen.—Part II.,' April 1925.

F. H. Gravelely records a rather similar habit for an Indian Epeirid—*Orsinome marmorea*[†]. This spider spins a large web above streams near Cochin, and when disturbed they fall into the water and float down stream until they touch a stone or plant. This is grasped and the spider walks down an inch or two below the surface and remains there till the danger is passed. In the same letter to which I have referred above, Dr. Nielsen tells me he has seen the Clubionid, *Clubiona grisea*, L. K., walk down a grass stem beneath the surface, taking air with it, when it is disturbed.

H. C. Abraham has described a Mygalomorph and an Attid marine spider from Malaya. The former, *Idioctis littoralis*, Abr. (Barychelidæ), makes a burrow closed by a trap-door in Mangrove swamps covered by the sea at high tide[‡]. The latter, *Diplocanthopoda marina*, Abr., was found on a rocky bank which was covered by the sea for at least twelve out of the twenty-four hours (at high tide there were from 4 to 5 feet of water over the bank). The spider appears to retreat into crevices in the rock and enclose itself in a silken chamber on the approach of the tide[§].

R. I. Pocock[||] has recorded the strange habit of a Borneo Thomisid, *Misumenops nepenthicola*, Poc., which lives just inside the pitcher of *Nepenthes* (Pitcher plant) and plunges into the liquid at the bottom if it is disturbed. This habit has recently been confirmed at Singapore, where the same species is found[¶]. As is well known, the plant attracts insects which fall into the liquid at the bottom of the pitcher and are digested by its fluid. Thus the spider by sitting near the top of the pitcher robs the plant of some of its prey. It spins a few threads to prevent itself slipping into the liquid, but it is somewhat surprising that it should be able to survive immersion, as it does when it seeks escape by plunging into it. It is restricted to one particular species of *Nepenthes*, so far as is known, in which the digestive glands are restricted to the base of the pitcher, and Monsieur Fage suggests that an analysis of the fluid of this *Nepenthes* might show it to be less powerful than that of species from which it has been analysed. Since this species has only been referred to by Pocock and Fage and never, apparently, described, I give a figure of the female, the female epigyne (which is small and faintly defined) and the male palp.

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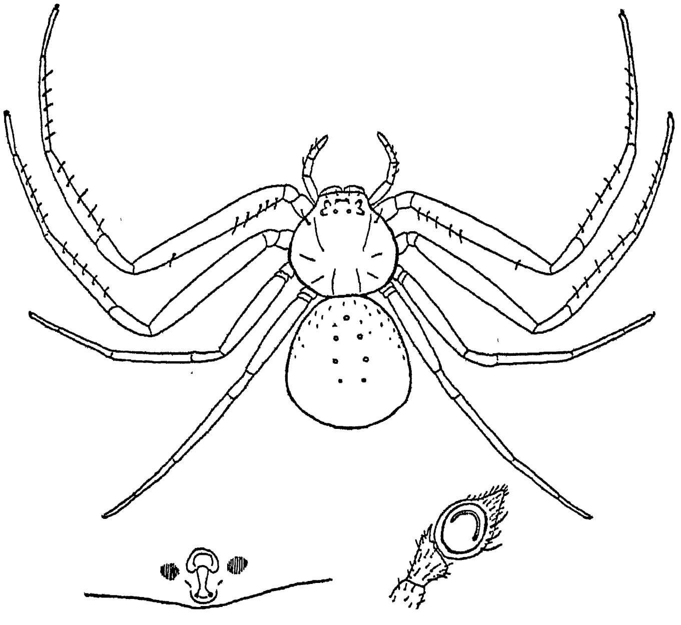
[*] 'Nature,' vol. xlvii. p. 102 (1893).
[†] Rec. Ind. Mus. p. 537 (1915).
[‡] Proc. Zool. Soc. p. 1098 (1924).
[§] Proc. Zool. Soc. p. 1357 (1926).
[||] 'Nature,' July 21st, p. 274 (1898).
[¶] L. Fage, 'Compte Rendu,' Seance du 17 Dec. 1926.

Fig. 2.



Misumenops nepenthicola, Poc., from Borneo.

I have to thank the British Natural History Museum authorities for allowing me to examine and draw specimens in their collection.

Aquatic spiders are known from the families Agelenidæ, Lycosidæ, Pisauridæ, Epeiridæ, Clubionidæ, Linyphiidæ, Ctenidæ, Attidæ, Barychelidæ, and Thomisidæ. The extent to which they live beneath the surface varies, and some can walk about comfortably with a bubble of air surrounding their bodies, whilst others rely on finding some cranny containing air or else enclose themselves and a supply of air in a silken cell. They have taken to this life independently of one another, and as our knowledge increases we shall find that others have a similar mode of existence. Spiders swarm on land from the Arctic to the Antarctic, in swamps and in deserts, and from 22,000 feet on Mt. Everest to below the level of the sea at high tide.

XXXV.—*Notes on the Biology of Spiders.*—III. *Miscellaneous.*

By W. S. Bristowe, B.A., F.Z.S.

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2. *Hersilia*'s Method of capturing Prey.
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4. Bugs as Guests and Parasites of Spiders.
5. *Euophrys lanigera*, Sim., in Britain.
6. Spiders in Birds' Nests.

1. *OONOPS DOMESTICUS* AND *OONOPS PULCHER*, THEIR HABITS AND DISTRIBUTION.

There are two British representatives of the family Oonopidæ—*Oonops pulcher*, Templ., and *O. domesticus*, Dal. Both are tiny flesh-pink spiders with six egg-shaped eyes arranged in a group near the front of the head. They are to be distinguished from one another roughly by their habits and accurately by the spines on their legs. *O. pulcher* is to be found under stones, under the bark of trees, amongst the roots of dry vegetation (Thrift, for instance) and old nests of Thrushes, Blackbirds, &c. *O. domesticus*, on the other hand, is restricted, so far as is known, to the interior of houses, where it is to be found throughout the year crawling on the walls or ceiling at night. In *O. pulcher* the lower side of the tibia of the first pair of legs has four pairs of spines and in *O. domesticus* five. The species agree in general appearance and are similar in that they both like dry conditions and are nocturnal in habits. During the day they live in silken cells and at night emerge in search of prey. They walk with a slow smooth gait, stretching out their front legs before them. Their sense of touch is, in fact, of greater service than that of sight, and when they touch something that moves they react immediately. If it is something to be avoided they dart backwards with lightning-like rapidity; if it is possible prey they either leap upon it immediately, or else, oddly enough, gently stroke it with their front legs, and then quite slowly move forward and deliver a bite. I have seen *Oonops* behaving like this to a small Psychodid fly, and the tickling seems to have a soothing effect, as the fly made no attempt to escape. In this family, and indeed in other members of the group Tetrastica, considerable use is made of the claws with which the legs of all spiders are terminated. Small insects are gripped, and in mating the male holds the female's legs with them. The mating-habits of *O. pulcher* I have described elsewhere (Proc. Zool. Soc. pt. iv. 1929). The stones under which *O. pulcher* is found frequently harbour other spiders, such as *Amaurobius similis*, Bl., and *Tegenaria atrica,* C.L.K., which live by means of their snares, in contrast to *Oonops,* which is a hunter. *Oonops,* perhaps on account of its small size and smooth gait, is tolerated by these spiders, and it even indulges on their hospitality to the extent of eating remnants of their feast, or insects too small to attract their attention which have become entangled in their snares. Thus it acts as a scavenger more than a parasite, although primarily it is, of course, a hunter on its own.

O. domesticus, Dal., was described from specimens found amongst books in Paris, and no other records, so far as I am aware, exist on the Continent up to the present date. In 1922 I recorded it from specimens I collected in a house at Cobham, Surrey*, and since then I have found it in four other southern counties, and Mr. T. Savory in two. Our present knowledge of its range in this country is as follows:—

Surrey: Cobham; Witley, near Godalming.
Sussex: Littlehampton; Cooden, near Bexhill.
Hampshire: Alverstoke (*T. S.*).
Middlesex: Highgate; Hampstead.
Devonshire: Westward Ho.
Glamorgan: Malvern (*T. S.*).
Oxfordshire: Oxford.

Any records, which occur in literature, of *O. pulcher* from inside houses refer almost certainly to *O. domesticus.* O. P.-Cambridge, for instance, in 'Spiders of Dorset,' records it from inside Bloxworth Rectory. It has not, so far as I know, been recorded from similar situations in the north of England.

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* Proc. S. Lond. Ent. N. H. S. 1922, p. 1.

Although some of my records are for summer months (May, July, August), the majority were made in winter (October, November, December). Adult specimens were found both in summer and in winter, and in this respect it resembles *O. pulcher*.

Oonops pulcher has a wide range in Great Britain, and has been recorded not only from various localities on the mainland of England, Scotland, Ireland, and Wales, but from several of the islands off the coast.

Abroad there still seems to be some doubt as to the occurrence of *O. pulcher*. De Dalmas has shown that specimens have been assigned to this species in error by E. Simon and others, and, according to his findings, *O. pulcher* was restricted to Great Britain, so far as was known, in 1916 *. I have found it in the Channel Islands, so it would be strange if it is entirely absent from the Continent, and Braendegaard has recently, no doubt correctly, recorded it from Denmark.

2. *HERSILIA'S* METHOD OF CAPTURING PREY.

In the early months of 1929 I was in India, but unfortunately my arrangements were such that I could devote very little time to spiders.

Hersilia savignyi, Luc., was found on tree-trunks near Calcutta. It sits perfectly still with outstrethed legs and body pressed flat against the trunk. In this position, with its mottled grey body, it is very hard to see. Here it sits motionless for hours on end, but, if an insect approaches, it shows itself capable of lightning-like activity. The spiders of this genus are peculiar in the extreme length of their spinnerets, and I was very interested to note that these were of particular service in capturing their prey. When an insect approaches the spider rushes towards it, and then, with its back towards its prey and its spinnerets stretched outwards at 45° to either side, it circles rapidly round it, thus fastening it to the tree-trunk with the silk from the spinnerets. Alternately it turns to give the insect a rapid bite and then continues its gyrations till the insect is completely swathed in fine silk. I saw one catch a small cockroach with a body nearly as large as its own in this way.

This method of capture is somewhat similar to that adopted by *Drassodes lapidosus*, Walck., in Great Britain. *Drassodes* inflicts a rapid bite, and then, curling its body round and keeping it as far as possible away, either runs rapidly around its adversary trailing a thick band of silk, or, in some cases, over and under it, thereby entangling the insect securely. In this way I have seen it overcome such fierce spiders equal to itself in size as *Amaurobius similis*, Bl., *Cœlotes terrestris*, Wid., and *Trochosa ruricola*, De Geer.

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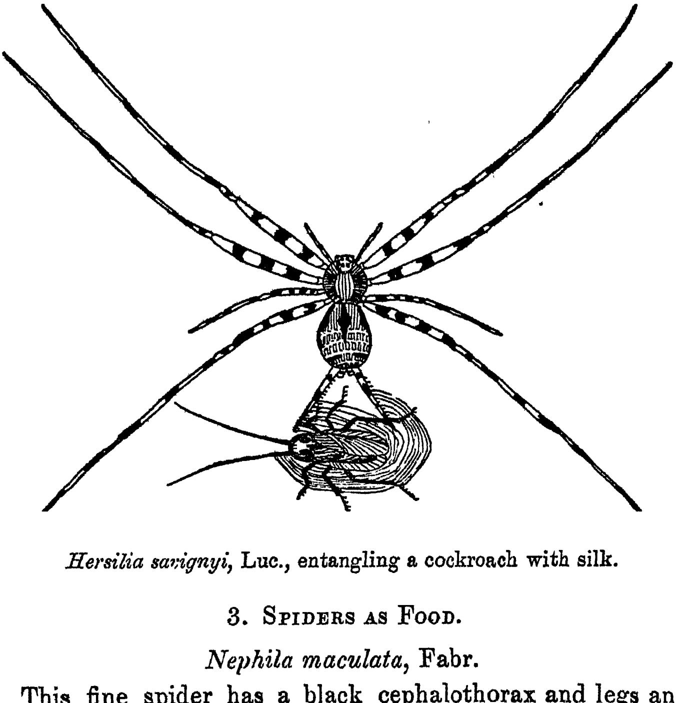
* Ann. Soc. Ent. Fr. lxxxv. (1916); see also Bull. de la Soc. Ent. Fr. 1920, p. 59.

Fig. 1.



Hersilia savignyi, Luc., entangling a cockroach with silk.

3. Spiders as Food.

Nephila maculata, Fabr.

This fine spider has a black cephalothorax and legs and olive-green abdomen. When full-grown the female's body measures 1½ inches. I found specimens in Ceylon, near Kandy, sitting in the centre of their immense orb-webs spun between trees in the forest.

In India I was informed that certain tribes, the Lepchas, eat the abdomen after first cooking the spider. I know of no other instances of spiders being used as food to-day, although such queer things as Longicorn larvæ and ants form part of the menu of the natives in Australia, locusts throughout the Near East, water-bugs in Mexico, and Palolo, marine worms in Samoa. Recently Mr. Sax Rohmer, the novelist, stated in the Press that he once ate a spider as a means of dispelling his inherent dread of them, and in classical, mediæval, and still more recent times, a diet of spiders was prescribed for various ailments. Thus, "swallowing a spider gently bruised and wrapped up in a raisin, or spread upon bread and butter," was a cure recommended for ague at the end of the eighteenth century. Judging from the following quotation from Topsel's 'History of Four-footed Beasts and Serpents,' published in 1658, spiders were esteemed as delicacies by some people :—

"When Alexander reigned, it is reported that there was a very beautiful Strumpet in Alexandria, that fed alwayes from her childhood on Spiders, and for that reason the King was admonished that he should be very carefull not to embrace her, lest he should be poysoned by venome that might evaporate from her by sweat. . . . And we in England have a great Lady yet living, who will not leave off eating them."

Here there is no mention of medicinal properties, and one infers that the great lady would not leave off because she liked them!

4. BUGS AS GUESTS AND PARASITES OF SPIDERS.

I found both *Cyrtophora citricola*, Forsk., and the smaller *C. cicatrosa*, Stol., in various parts of India. The tiny silvery spiders of the genus *Argyrodes* which make a point of living in other spiders' webs were found associated with both these species. In addition, I noticed in the webs of *C. cicatrosa*, Stol., a species of *Uloborus*, and some long-legged slender Reduviid bugs. These bugs appear to act both as scavengers and parasites, for, according to Mr. F. H. Graveley, they devour insect-remains and also the spiders' eggs, which are arranged in a string in the centre of the snare. I saw as many as eight cocoons so arranged in one snare. Mr. Graveley informs me that the following species of bug have been recorded from the webs of this species:—

Eugubinus araneus, Dist.	Bombay.
—— *intrudans*, Dist.	Cochin.
—— *reticolus*, Dist.	Calcutta.

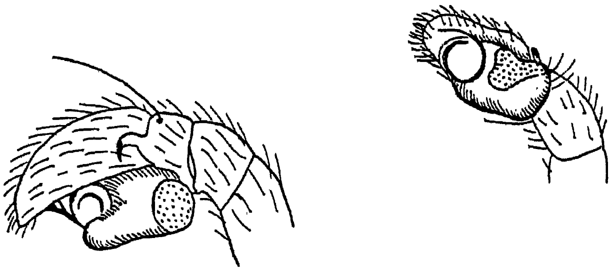
A species of *Ghilianella* has also been found in spiders' webs, but the kind of spider is not recorded.

A recent case has been reported where the tables are turned, and where a spider destroys bed-bugs. Some barracks at Athens were infested with these insects, but a sudden decrease led to an investigation which pointed to the conclusion that a spider, *Thanatus flavidus*, Sim., was responsible for this. In the laboratory the spider killed between thirty and forty per day, and its young, soon after hatching, subsisted on a diet of nothing else. It is difficult to know how much credence to give to the conclusion, but, whilst admitting that the spiders may have had some effect in keeping down the numbers, I am not very inclined to believe that they alone were responsible for the sudden decrease. Spiders are not specialists as regards their food. The paper is published by Dr. N. T. Lorando in the 'Scientific Monthly,' 1929.

5. *Euophrys lanigera*, Sim., in Britain.

An adult male, which I caught on the window of a house at Budleigh Salterton, S. Devon, in August 1920, was the first British record for this southern European species. In August 1927, I caught a very young Attid on the wall of a house at Taunton which may also belong to this species.

Fig. 2.



Euophrys lanigera, Sim. Male palp.

A figure of the male palp is given by Simon in 'Arachnides de France,' tome 3, tab. 11, but since this is somewhat unsatisfactory I include drawings here made from my specimen. Dr. A. Jackson, to whom I submitted my specimen, had confirmation as to its identity from Mons. E. Simon himself.

6. Spiders in Birds' Nests.

Birds' nests contain a varying number of parasitic, as well as scavenging and carnivorous, arthropods, so they form a suitable habitat for spiders. Some of the spiders are transported there in moss and nest-materials, whilst others find their way there by themselves. Even in old nests, long after the birds have left, spiders are to be found, for the nature of the nest is such that it affords suitable protection not only for them but also for insects on which they can feed. In the old nests of Thrushes and Blackbirds *, for instance, I have found *Oonops pulcher*, Templ., *Harpactes hombergii*, Scop., *Xysticus cristatus*, Clerck, *Philodromus aureolus*, Walck., *Oxyptila* sp., *Clubiona compta*, C. L. K., *Clubiona* sp., *Threidion tinctum*, Walck., *T. pallens*, Bl., *Linyphia clathrata*, Sund., *Lepthyphantes leprosus*, Ohl., *L. minutus*, Bl., and *Hypomma cornuta*, Bl., but have noted that the species vary with the nature of the shrub or tree in which the nest is built. Apart from this, the kinds found in different birds' nests vary quite naturally with the position and nature of each, and also to some extent according to locality. As illustrations of this I can give the following :—

(A) Rooks' nests made in the tops of trees chiefly of twigs:

(*a*) Peebles: *Lepthyphantes*, imm.
Diplocephalus beckii, Camb.
Lophocarenum nemorale, Bl.
(*b*) Oxford: *Theridion tinctum*, Walck. One young. This nest was kindly sent me by Mr. E. M. Nicholson.

(B) Gulls' nests built on the ground and made of dry grass, Thrift, etc.:

Oonops pulcher, Templ. Scilly Isles.
Harpactes hombergii, Scop. Scilly Isles.
Oxyptila atomaria, Panz. Scilly Isles, several.
Xysticus cristatus, Clerck. Skomer Is.
—— *kochii*, Thor. Skomer Is.
Lophocarenum nemorale, Bl. Skomer Is.
—— *parallelum*, Sim. Grassholm.
Tiso vagans, Bl. Scilly Isles, Grassholm.
Pocadicnemis pumila, Bl. Scilly Is.

(C) Shags' and Cormorants' nests built on bare rocks near the sea and made of *Fucus* and other kinds of seaweed. The birds are dirty and the weed is sticky and decomposing:

Halorates reprobus, Camb. Scilly Isles, abundant.
Lophocarenum nemorale, Bl. Scilly Isles, Skomer Isles.

These notes appear to indicate that there are no spiders entirely or nearly restricted to birds' nests, as in the case of ants' nests, where such species as *Evansia merens*, Camb., *Thyreosthenius biovatus*, Camb., *Acartauchenius scurrilus*, Camb., and *Tetrilus arietinus*, Thor., are restricted entirely, or almost so, to such situations. It is too early from such scanty data to be certain that there are no birds' nest species, but the transitory nature of these nests would appear to make it unlikely.

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* Mr. A. H. Hamm kindly gave me two tubes of spiders he had collected in the nests of these birds a few years ago, but it is greatly to be regretted that these were lost.

XXXVI.—*On the General Morphology of the Anaspid,* Lasanius, *Traquair.* By O. M. B. BULMAN, Ph.D., D.I.C., A.R.C.S.

AMONG the primitive vertebrates of the Downtonian of Scotland, *Lasanius* is certainly the most puzzling regarding the details of its anatomy. Specimens are often beautifully preserved, but the genus seems to have been surprisingly deficient in ossified skeleton and dermal armour. Thus, although the dorsal row of scutes and the rays of the caudal fin may be admirably displayed, and the body is frequently preserved as a black film with a definite outline at least in the caudal region, and while there is even in some instances evidence of the metameric musculature, yet the only bony structures are the peculiar branchial ossicles, and the unique "post-cephalic rod" system round which so much discussion has centred. Of dermal armour, mere traces have been recorded. It is probably true that of the actual morphological details, as much was known to Traquair when he prepared his original descriptions of this form as is known to-day, and it is only in the interpretation of these structures that subsequent knowledge has advanced.

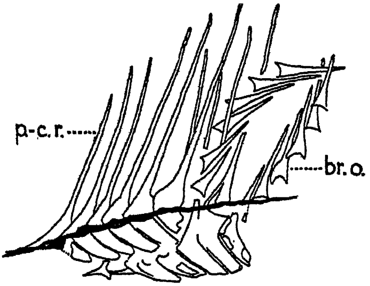
The genus was described by Traquair in 1899 and further notes were published in his supplementary Report of 1905. As might be expected, Kjaer's monograph on the Anaspida of Norway (1924) led to a renewed interest in the problem of *Lasanius,* and a number of papers has lately appeared, the principal of which are those of Simpson (1926) and Stetson (1927). The position of *Lasanius* and the Anaspida generally is summarised by Stensiö (1927) in the light of his remarkable discoveries among the Osteostraci.

The genus relates to the Anaspida by the row of dorsal scutes and the branchial ossicles, which form a slanting chain along the sides of the head, corresponding, as has long been suspected, to the sloping rows of branchial openings in *Birkenia* and other more typical anaspids. When it was realised, as a result of Kjaer's work, that these scutes were really dorsal in position, and not ventral as had previously been supposed, it was apparent that the tail was reversed heterocercal (or hypocercal) as in other Anaspida, and that the post-cephalic rod series on either side were ventrally and not dorsally approximated. The structure of the head, except in so far as it may be compared with that of allied genera, remains unknown.

The Post-cephalic Rod System.

This very characteristic structure comprises a row of eight elements on either side. Each bone is L-shaped, with a short, rather broad and flattened base, and a long slender ascending process; and there is a gradual increase in the size of the elements and particularly in the length of the ascending rod as the series is traced forwards. The size relation of the series as a whole to the animal varies slightly in different individuals, either capriciously or as an age-feature. It is often to be observed, and was indeed remarked by Traquair, that the angle between the two rami of the post-cephalic rod gradually decreases as we proceed back along the series, being about 110° in the anterior pair, and only 75°–80° in the posterior pair; this feature will be referred to subsequently. A slender spine originates from the outer edge at the angle between the two rami in all the rods except possibly the first, where it is represented by a slight protuberance (Simpson, p. 400).

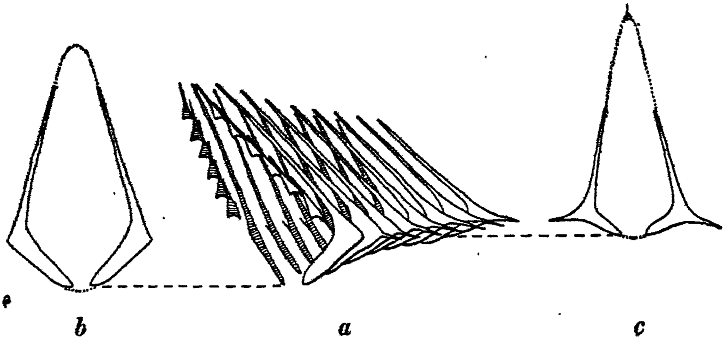
Fig. 1.



The post-cephalic rods (*p.-c.r.*) and branchial ossicles (*br.o.*) of *Lasanius problematicus*; specimen 1669, Huxley Museum (Royal College of Science). × 5.

There seems good reason to believe that the system of scales in *Birkenia*, *Pterolepis*, etc., corresponds in arrangement to the underlying myotomes (Kjaer, p. 95) and that the inclination of the ventral and lower-lateral, and of the lower- and upper-lateral rows of scales expresses the zig-zag course of the myotomes themselves. With these scales have been compared the post-cephalic rods of *Lasanius*, the angle between the ventral plate and the ascending process corresponding to the angle between the ventral and lower-lateral rows of scales in such a form as *Pterolepis* (Stetson, p. 254). This has led to the supposition that the rods are dermal structures (Kjaer, pp. 71 & 72), and Stetson holds (p. 254) that, even if they are subdermal in position, they were primarily dermal and originated as a modification of the dermal plates. If, on the other hand, these rods were situated in the muscular wall of the animal, as seems not unlikely, they probably corresponded in position to the myosepta, the flattened blade-like bases lying imbedded between the muscular tissue of adjacent myotomes. In other words, they may then have occupied a position at the junction of the dermis or corium and the myoseptal mesoderm, and thus suggest mesodermal origin. Such an origin appears to the writer not improbable, although, as Stetson observes (p. 256), the distinction between dermal- and cartilage-bones in these primitive vertebrata may not be so fundamental, since what are now pre-formed in cartilage may in a more remote past have had a dermal origin.

Fig. 2.



Reconstruction of the post-cephalic rod system and branchial ossicles of *Lasanius*. × 5 approx. *a*, isometric projection of the complete structure; *b*, front view of the anterior pair of rods, the branchial ossicles omitted and the approximate body-section at this level indicated by the dotted line; *c*, back view of posterior pair of rods, with lateral spines (fin-supports) and body-section again in dotted line.

On the assumption that these bones were myoseptal in position and, further, were situated behind the gill-chamber, a new reconstruction of the post-cephalic region has been attempted, and the following notes are added :—

1. *Position of the Bases of the Post-cephalic Rods.*—Kjaer considered (p. 68) that the angle between the ventral and lower-lateral scales in *Pterolepis* merely follows the zig-zag line of the myotomes, revealing nothing of the

form of the ventral surface of the body; and that there is no justification for believing the latter to have been markedly flattened. In the related *Lasanius*, it is probable that the bases of the post-cephalic rods were similarly inclined forwards to conform with a forward V-ing of the ventral part of the myotomes (see fig. 4). There is no evidence of actual contact between the members of each pair of rods (as suggested by Stetson, p. 251, and fig. 3, p. 258) the extremities of the basal plates being rounded or obtusely pointed; this is taken to indicate that they possessed only a ligamentous connection, or that they were united by uncalcified cartilage.

2. *Inclination of the Ascending Processes.*—There is no evidence as to the angle at which the ascending processes of the post-cephalic rods were inclined, but the most satisfactory arrangement is obtained with an inclination of about 45°.

3. *The Nature of the Ventral Surface.*—Having inclined forwards both the basal plates and the ascending processes at more or less arbitrary angles, we may yet draw certain conclusions concerning the ventral surface which results, because no very great deviation is possible from the fixed angle between the two rami of the post-cephalic rods. Roughly speaking, the greater the inclination allotted to these rods, the flatter will be the resulting ventral surface. Although Kjaer is not in favour of a flattened surface in such forms as *Pterolepis*, it seems that a moderately flattened ventral surface in *Lasanius* is unavoidable. The fact that the two limbs of the post-cephalic rod meet at a more acute angle in the posterior pair than the anterior pair results in the occurrence of a more flattened ventral surface at the back of the post-cephalic rod structure than at the front (fig. 2 *b* & *c*)—in other words, the body-section is more triangular posteriorly (as in the Osteostraci) and more ovoid anteriorly. In the general reconstruction (fig. 4) this flattening has been continued and intensified posteriorly as far as the postulated anal fin, behind which the body is believed to have been lenticular in section.

The Branchial Ossicles.

These are six in number on either side, and have the well-known triangular form shown in fig. 1 (*br.o.*). The lower edge is concave and is believed to have bounded the branchial openings dorsally. As pointed out by Simpson (p. 399), these ossicles possibly have their homologues in *Pharyngolepis* and perhaps also in *Pterolepis* in the form of strengthening ribs inside the branchial band. These ribs in *Pharyngolepis* are "more deeply lying" (Kjaer, p. 60) and are considered by Simpson (p. 400) to be sub-dermal and not modified scales. On the other hand, Stetson (p. 252) regards the branchial ossicles of *Lasanius* as external in part at least, since he records on these a fine striation which had not been observed by previous writers.

Stetson orientates these so that "the thin spine-like anterior end of each ossicle underlies the broad posterior end of its neighbor." In my own material and in Simpson's description the reverse holds good, the spine-like prolongation overlying the base of the immediately anterior ossicle in each case. The ossicles appear to have been united during life by ligamentous tissue (or by soft cartilage) since they rarely, if ever, occur scattered, and in the specimen figured (fig. 1), the complete chain on one side has swung over into a reversed position, presumably as a result of the action of gentle currents on the half-macerated remains. In my view, a similar displacement is shown in fig. 2 of Stetson, so that the branchial ossicles, although still associated, are not in their true position; this would account for the orientation of the ossicles adopted by that author.

It may well be that the series was not so compact as is generally represented and as is shown in the present reconstruction, but that the ascending spines were spaced parallel to one another like the ascending processes of the post-cephalic rods. In this event, it is possible that these too were myoseptal in position, although it is then more difficult to dispose their superficially broadened bases.

In *Pterolepis* and other anaspids, the branchial band was inclined at approximately 35°, but allowing that some parallelism is requisite between the branchial ossicles and the post-cephalic rods, this angle was probably nearer 45° in *Lasanius*.

As Stensiö observes (p. 311), the Anaspida have lost the homologues of the anterior branchial openings of the Osteostraci.

Function of the Post-cephalic Rod System.

It has been held by many authorities that the post-cephalic rods in *Lasanius* were either gill-arches, or at least a stage prior to the formation of the true gill-arches (Stetson, p. 254). Stensiö's work has made it clear that the branchial ossicles correspond to the more posterior gill-openings of the Osteostraci, and they thus lie at the hinder end of an assumed oralo-branchial chamber of cephalaspid type. Not only must the post-cephalic rods then lie behind the gill-openings (as was indeed admitted by Stetson, p. 257), but it can now be inferred that they lie well behind the branchial region of the organism, proving Simpson's contention that they certainly were not gill-arches (Simpson, p. 399).

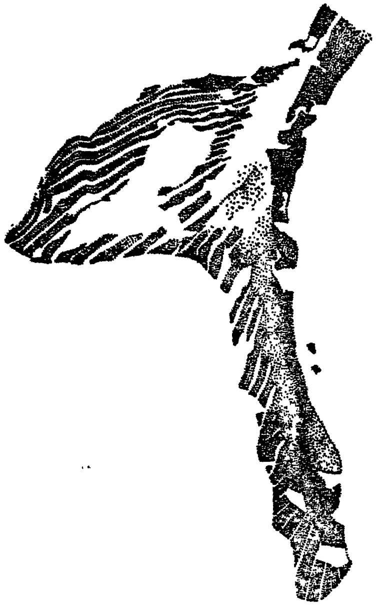
From their position, it appears that they constituted a structure homologous with the pectoral girdle of more advanced forms, although the metameric repetition of the elements has no parallel. It may be mentioned that Kjaer (p. 100) regards the pectoral plates of such forms as *Pterolepis* as agreeing in form and position with the clavicular plates (cleithrum). As Gregory has stated (p. 350) "the shoulder-girdle of fishes arose at the dividing line between the gill-chamber in front and the muscular body behind, and . . . its principal office was to prevent the thrusts from the body and pectoral paddles from interfering with the branchial apparatus." Is it not likely, therefore, that in such a form as *Lasanius*, devoid of the heavy cephalic shield of the Osteostraci, and lacking even the rigidity of the dermal scales of the other Anaspida, these post-cephalic rods fulfilled a very necessary function in protecting the gill-chamber from body thrusts? Of all the primitive vertebrates then living, *Lasanius* seems to have been the most actively swimming, and even in the armoured *Pterolepis*, Kjaer regards the post-branchial plates (usually compared with the first pair of post-cephalic rods in *Lasanius*) as having "supported and strengthened the dermal part of the branchial apparatus" (p. 70). United basally by ligaments, and placed severally between the myotomes, the post-cephalic rods are capable of affording a rigid barrier in front of the muscular body, and behind the somewhat delicate oralo-branchial chamber. In addition, these structures probably served to protect the heart and other organs (*e. g.*, possibly a functional pronephros) and although the lateral spines indicate the probable existence of a "pectoral fin," the support which they afforded in that connection was perhaps of secondary importance.

The General Reconstruction. (Fig. 4.)

The caudal fin is admirably preserved in the Huxley Museum specimen, and is figured below (fig. 3). The fin-rays appear as relatively broad and not too rigid rods, which in some cases widen slightly distally, and do not increase in number by interpolation. There is a suggestion of a small lobe, unsupported by fin-rays, lying ventral to the prolongation of the body axis, and this has accordingly been added in the reconstruction; a similar "hypochordal lobe" is present in *Pterolepis*.

The posterior portion of the body is so slender in all known examples that, in making a reconstruction, it must be assumed that this was almost the full height and therefore that the body in this region was extremely flattenend.

Fig. 3.



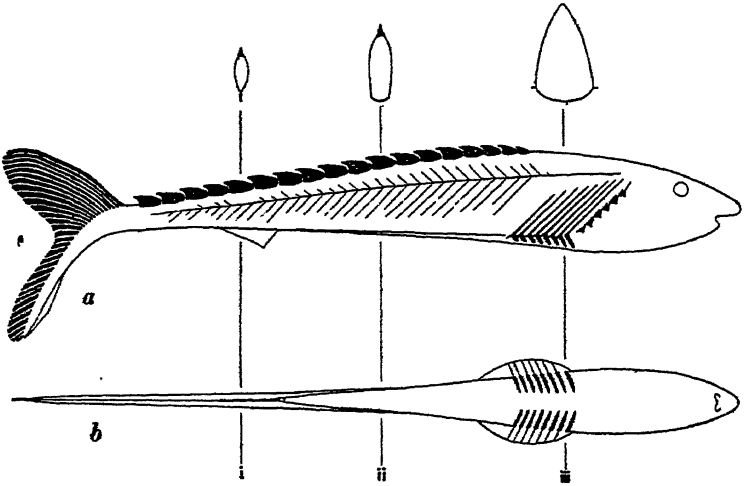
Caudal fin of *Lasanius problematicus*. Specimen 1669, Huxley Museum (Royal College of Science). × 5.

In dealing with *Pterolepis*, Kjaer states (p. 69) that the ventral scale system narrows posteriorly and terminates in front of the anal fin. A similar configuration is given to the corresponding surface of *Lasanius*, the here rather more flattened ventral surface tapering away in front of the anal fin which, as indicated by Simpson (p. 399), may reasonably be assumed to have been present in this form, even though no definite evidence of its existence has yet been found.

The post-cephalic rod system and branchial ossicles have already been described, but an attempt has been made to represent their appearance in true profile and in ventral aspect. The pectoral fin may have had a greater extent than is shown, since Stetson (p. 249) records one instance where the external spine is 4 mm. in length. It is obvious that this fin was immovable and served for balancing purposes, not taking any important part in the propulsion of the body.

The shape of the head is not known with any certainty. In the majority of specimens, there is a sudden narrowing of the ventral region just in front of the branchial ossicles, which is expressed in the curious conformation given to this part by Traquair in his second reconstruction (1905), and by Abel (1919). It is not impossible that this represents an unpreserved, thin-walled oralo-branchial chamber. The position of the mouth and orbits is hypothetical. As here reconstructed, the body of *Lasanius* possesses something of the general configuration of the Osteostraci, in the anterior widening and the rather flattened ventral surface.

Fig. 4.



Reconstructions of *Lasanius*. × 2 approx. *a*, profile; *b*, ventral aspect. The shape of the body in section at the points i, ii, iii, is shown above.

Indications of the myotomes are to be seen in Traquair's figures, and their course is tolerably certain. The lateral flexure of these, corresponding to the angle between the upper- and lower-lateral plates of *Pterolepis* and other forms, may indicate the situation of the notochord, the existence of which, although questioned by Raymond (1925), is absolutely necessary to the proper functioning of the myotomal muscles.

The evidence of thin dermal scales in this genus is very imperfect, but delicate scales seem to have been present in the more mature individuals. The loss of scales is now generally regarded (Stensiö, p. 313) as secondary, though Kjaer (p. 94) saw in this a primitive condition. The dorsal scutes are probably not very closely connected with the normal scale system (Kjaer, p. 94).

My thanks are due to Professor E. W. MacBride, F.R.S., for permission to describe and figure the specimens in the Huxley Museum, and to Professor D. M. S. Watson, F.R.S., for his kindness in reading the MS of this paper.

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XXXVII.—*Papers on Oriental* Carabidæ.—XXIII. By H. E. Andrewes.

On the Förster Collection of Sumatran *Carabidæ*.

In the year 1903 two short papers on Carabidæ by J. Bouchard were published in the 'Annals of the French Entomological Society'; these had reference to two collections, both recently formed in the island of Sumatra, the first that of the author, and the second that of Prof. Förster. For many years I was unable to trace these collections, but I have now ascertained that the Bouchard collection is in the hands of Mr. René Oberthür at Rennes, while the Förster Collection is in the Museum of the Lycée at Mulhouse. The second of the two papers (pp. 177–80) deals exclusively with the genus *Pogonoglossus*, and includes the descriptions of three new species, which formed part of Bouchard's collection, and of which the types are all now in Mr. Oberthür's collection. With the kind permission of the Rector of the Academy at Strasbourg, and the co-operation of the Proviseur of the Lycée at Mulhouse, and of Mr. P. Scherdlin, Conservator of the Zoological Museum at Strasbourg, to all of whom I offer my warm thanks, the Förster Collection, dealt with in the first paper (pp. 169–176), has been sent to me for examination. Unfortunately this collection has suffered from the attacks of *Anthrenus*, and some specimens have been destroyed, including one of the types; among these are the examples of *Chlaenius pictus*, Chaud., *Ophionea nigrofasciata*, Schm.-Goeb., *Ophionea försteri*, Bouch. (type), and *Catascopus facialis*, Wied., but, apart from these losses, the collection is not in bad condition. It has long been evident to me that some of Bouchard's identifications were inaccurate, and this proves to be the case; the intention of this paper is, as far as possible, to correct such errors as were found, and generally to offer some remarks on the species enumerated, though only those are referred to which appear to call for comment. In addition to the Sumatran material, there are a few specimens from Java and Borneo.

Clivina javanica, Bouch (not Putz.) = *C. castanea*, Westw. (Proc. Zool. Soc. 1837, 128).

Clivina extensicollis, Bouch. (not Putz.). The example so named in the collection belongs to an undescribed species of the genus, but possibly this is not the specimen identified by Bouchard, which, according to the list sent to the Proviseur and returned by him, has been destroyed.

Clivina lignicola Bouch. (p. 169) = *Psilus* (*Ardistomis*) *paradoxus*, Putz. (Ann. Soc. Ent. Belg. xi. 1868, 21). The type and a cotype are in the collection. The author was evidently in doubt regarding the genus, and hesitated between *Clivina* and *Dyschirius*. He tells us that he took a number of specimens himself, never on the ground, but always under the decayed bark of the trunks of trees lying on the soil.

Dyschirius debilis, Bouch. (not *Dyschirius debilis*, Putz. = *Phreoryctes pusillus*, Schm.-Goeb., in litt.) = *Trilophus* (*Dyschirius*) *interpunctatus*, Putz. (Ann. Soc. Ent. Belg. x. 1867, 97). Schmidt-Goebel's species was not described, but was figured on pl. iii. fig. 6 of his 'Faunula Coleopterorum Birmaniæ' (1846). Bouchard considered that his specimens agreed well with this figure, but I am unable to agree with his view. In any case, Schmidt-Goebel's example is lost, so that there is no means of deciding the question.

Tachys acaroides, Bouch. (not Motch.) = *T. eurynotus*, Andr. (Ann. & Mag. Nat. Hist. (10) iv. 1929, 357). The species is quite unconnected with *acaroides*, which, so far as I know, is confined to Ceylon. *T. eurynotus* belongs to the *haliploides*-group of my Revision and is nearly allied to *T. striatulus*, Andr. (Ann. Mus. Civ. Gen. li. 1925, 474).

Tachys subfasciatus Bouch. (not Putz.). The unique specimen belongs to an undescribed species, having no connection with Putzey's insect, but falling within my *fasciatus* (*triangularis*)-group.

Oxycentrus angustus, Bouch. (not Bates) = *O. striolatus*, Andr., a new species, of which the description is now in the press.

Stenolophus rectifrons, Bouch. (not Bates) = *S. smaragdulus*, F., var. *quinquepustulatus*, Wied. (Zool. Mag. ii. 1, 1823, 58).

Ophionea försteri, Bouch. (p. 172). As mentioned above, the type, the only example taken by Förster, has been destroyed, but the species is a very distinct one and there is no doubt about its identity. Fortunately Bouchard himself took a considerable number of specimens, some of which I have seen in Mr. Oberthür's collection. The species occurs also in Borneo.

Casnonia litura, Bouch. (not Schm.-Goeb.) = *Odacantha* (*Casnonia*) *fuscipennis*, Chaud. (Bull. Mosc. 1850, i. 26).

Drypta aeneipennis Bouch. (not Bates). The unique specimen came from Borneo, and the species is undescribed. So far as I am aware, Bates's species has hitherto been found only at Bhamo in northern Burma.

Orthogoniüs schaumi, Bouch. (not Chaud.). Chaudoir's species is confined to Ceylon, and the solitary example taken by Förster belongs to an undescribed species.

Cyclosomus sumatrensis, Bouch (p. 174). The type, which is unique, is in a fair state of preservation, and, judging by it, the species appears to be a good one, though when more material is available it may prove to be only a varietal form of *C. flexuosus*, F. In Trans. Ent. Soc. Lond. 1923 (1924), 464, I gave a table for the discrimination of the three Asiatic species of the genus then known to me. Bouchard's species differs from *flexuosus* in its rather smaller and narrower form, and in the deeper striation of the elytra. The pattern on the elytra is very similar, but instead of the two black spots, one on each side, near apex, there is a dark crescent-shaped marking (convex backwards) in the Sumatran species, which, barely touching the apex, runs forward on each side to interval 4, without, however, joining the short arm which extends backwards along that interval from the median fascia.

Mochtherus tetraspilotus, Bouch. (not Macl.) = *M. magnus*, Andr., a new species of which the description is now in the press. Examples were taken both in Sumatra and Java, but only one Sumatran specimen remains.

Stenotelus opacus, Bouch. (p. 175). The species is unique in the genus, and the insect has so characteristic a form that it is unlikely to be confused with any other. The collection contains the type and a cotype, both apparently from Sumatra, though Java is also given as a locality, and both in a moderate state of preservation. Bouchard himself took a number of specimens and gives some details regarding the mode of life. Examples of the species have also been met with in Perak and Borneo.

Dolichoctis tetracolon, Bouch. (not Chaud.) = *Coptodera tetrastigma*, Chaud. (Ann. Soc. Ent. Belg. xii. 1869, 174). Both Java and Sumatra are given as localities, but the two specimens in the collection appear to come from Sumatra. *D. tetracolon* does occur in Sumatra, and both species are widely spread in the East.

Celaenephes försteri, Bouch. (p. 176) = *C. parallelus*, Schm.-Goeb. (Faun. Col. Birm. 1846, 78, t. 2. f. 5). The collection contains the type only of this species. Judging only by size and colour Bouchard considered his species distinct from that of Schmidt-Goebel, but where, as in this case, a species has a very wide area of dispersion, these two characters are usually subject to considerable variation, and there is apparently no other distinguishing feature.

XXXVIII.—Cardiocondyla bicolor, *sp. n.* (*Hymenoptera,* Formicidæ), *a Species of Myrmecine Ant new to Science.*

By Horace Donisthorpe, F.Z.S., F.E.S., etc.

The genus *Cardiocondyla*, Emery (1869), consists of a number of small, very characteristic ants, of which some fourteen species and a number of varieties have been described. They occur in the Mediterranean region, Africa, Madagascar, India, Malaya, Oceania, and the Antilles.

Their colonies are not populous, and they live in the ground, the entrance to the nest consisting of a small hole.

A number of females may be present in a colony, but very few males. In some cases the latter are winged, in others apterous; both winged and apterous males may be present in others.

Santschi has seen the ergatoid male carrying the larvæ in the same manner as the workers, and he is of the opinion that the male winged form in this genus is on the way to extinction.

☿. Head, thorax, pedicel, last segments of gaster, antennæ, and legs clear reddish yellow, head and last segments of gaster sometimes slightly darker, long first segment of gaster shining black, eyes dull black.

Head, thorax, and pedicel evenly and finely coriaceous, dull; gaster smooth and shining, with very minute, yellow, decumbent hairs arranged longitudinally in rows.

Head oblong, broader than thorax, *eyes* slightly longer than their distance from base of mandibles; *scape* of *antennæ* curved and slightly thickened towards apex, not reaching base of head; *meso-epinotal* suture distinct; *teeth* of *epinotum* sharp, triangular, slightly pointing outwards and downwards; *post-petiole* about one-third broader than *petiole*.

Long. circa 1·7 mm.

Described from six workers taken in Palestine, in 1930, by Drs. Scheinkin and J. Carmin, on *Ficus sycamorus*.

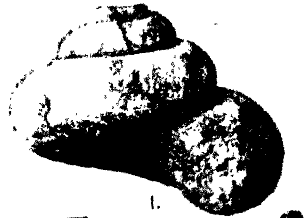
Type and paratypes in the British Museum Collection.

This species comes nearest to *C. parvinoda*, Forel, in the shape of the post-petiole; but the latter insect is more shining and has a shorter and rounder gaster, the spines are straighter and the space between is smooth and shining.

From *C. emeryi*, Forel, it may be known by its sharper spines, considerably narrower post-petiole, lighter colour, less strong sculpture, etc.

From *C. wroughtoni*, Forel, it differs in colour, shorter spines, sculpture, etc.

C. nuda, Mayr, has much shorter spines and the sculpture is quite different.



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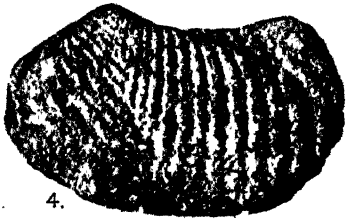

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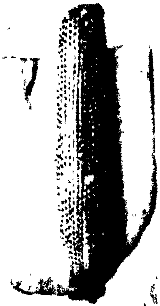

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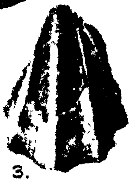

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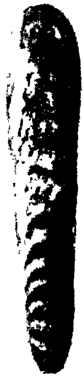

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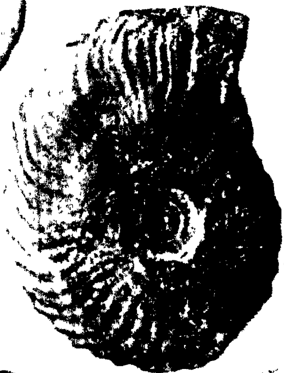

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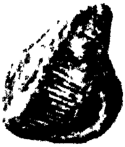

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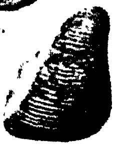

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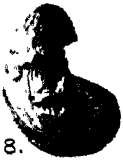

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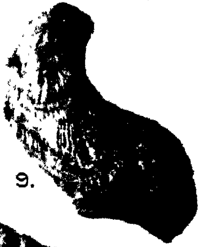

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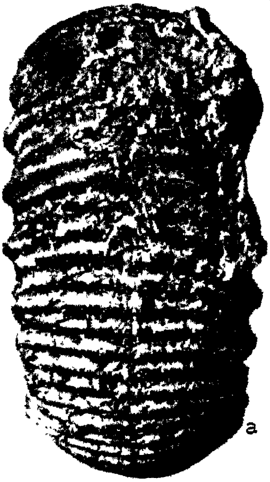

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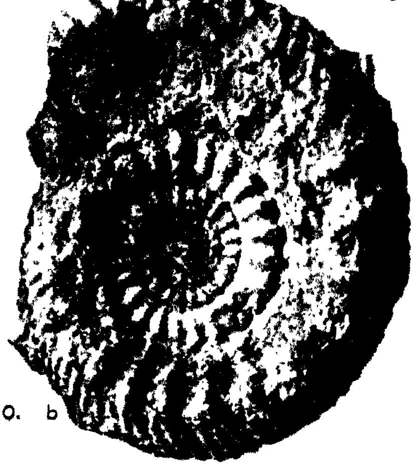

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L R Cox, photo.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

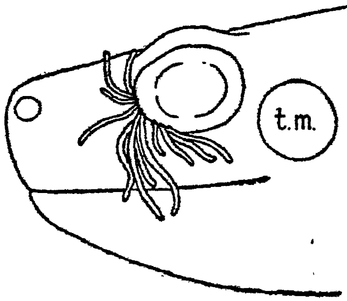
No. 34. OCTOBER 1930.

XXXIX.—*An Oligochæte Worm parasitic in Frogs of the Genus* Phrynomerus. By J. STEPHENSON, D.Sc., F.R.S., British Museum (Natural History).

SOME months ago Mr. H. W. Parker, of the British Museum (Natural History), handed over to me a frog, *Phrynomerus microps*, which had been recently received from Bauchi Province, Nigeria, in the condition shown in fig. 1. From the anterior canthus of each eye and its neighbourhood about a dozen small worms were hanging out in a cluster. On trying to extract some of the worms from their position two of those at the anterior angle of the eye were broken, though my efforts at removal were quite gentle; but the worms which had inserted themselves rather further back, under the anterior part of the lower lid, were removed perfectly easily, and those further forward came away more easily after incising the lid in two places. The part of the worm which was hidden beneath the eyelid was the anterior; some of the worms were concealed for nearly their whole length, some for half their length, others for less; one specimen had both its anterior and posterior ends underneath the lower lid, the middle part of the body being free. Most of the specimens removed for examination showed signs of having lost their hinder ends, perhaps by the bite of another frog, and were beginning to regenerate; the only specimen which showed the normal form of the posterior end was that which was found with both anterior and posterior ends beneath the lower eyelid. On examination the worms proved to be a new species of the genus *Nais*, to which the name *Nais bauchiensis* was given.

Some weeks afterwards Mr. Parker brought me a frog belonging to another species of the genus *Phrynomerus*—*P. bifasciatus*, from Beira, Portuguese East Africa—which had been some years in the Museum, and in which, while no trace of infestation by parasites was visible externally, on dissection he had found the Harderian (lachrymal) glands to be full of small worms. After reflection of the mucous membrane of the roof of the mouth the gland was seen on each side as a swelling behind the internal nares and on the inner side of the bulging caused by the bulb of the eye; fourteen small worms had been evacuated from the gland of the right side, now empty, while that of the left side appeared as a sac, through the semi-transparent wall of which the parasites were easily visible. These worms were found to belong to the same species as the preceding, but were considerably smaller.

Fig. 1.



A cluster of *Nais bauchiensis* hanging out from under the eyelid of the frog *Phrynomerus microps*. *t.m.*, tympanic membrane.

This discovery sent us back to the first frog (*Phrynomerus microps*, from Nigeria), in order to find out whether there were any worms inside the Harderian glands in it also. Mr. Parker dissected up the mucous membrane of the roof of the mouth, and found both Harderian glands much enlarged, almost as large as the bulb of the eye, and transformed into a thin-walled sac, through the transparent wall of which numerous worms could be seen filling out the cavity.

Nais bauchiensis, sp. n.

Bauchi Province, Nigeria; attached by the anterior ends in the anterior canthus of the eye and within the lower lid near the canthus, the hinder ends waving freely, and also contained within the Harderian glands, of the frog *Phrynomerus microps*.

Beira, Portuguese East Africa; within the Harderian glands of the frog *Phrynomerus bifasciatus*. Coll. C. Grant.

The specimens from Nigeria measure 7·5 to 11 mm. in length, 0·2 to 0·3 mm. in diameter; those from Beira are smaller, 3·5 to 5 mm. in length, and about 0·2 mm. in thickness. The number of segments varies in the Nigerian specimens from 62 to 93, in those from Beira from 26 to 39. Many of the worms appear to have lost their hinder ends, and in some of them regeneration has begun, with the production of a small terminal triangular lobe; but no great amount of regeneration has taken place. In worms which apparently possess a complete hinder end the posterior portion of the body tapers somewhat. The smaller number of segments in the worms from Beira may be due to the fact that these were taken from the Harderian glands, and had possibly undergone more frequent mutilations of the hinder end before reaching this refuge; the segments in the Nigerian specimens were counted in worms which were hanging out of the anterior canthus, and perhaps had not long been exposed to the possibilities of mutilation.

None of the worms showed any sign of a budding zone in the middle of the body; the only indication of asexual multiplication was in a specimen from Nigeria. Here the first four seta-bearing segments are close together, and less transparent than the others, while the anterior end is rather flat, but with rounded corners, as if truncated; the first ventral setal bundles are close to the anterior end, segment i. and the prostomium not as yet having formed; the dorsal bundles begin in segment iv., as usual in this species. This worm would seem to be the hinder component of a chain of two which had recently been separated, separation having taken place before the complete formation of the head; it is noteworthy that the usual number of new segments (five) are formed at the head end, and that therefore (since, as will be described, the dorsal setæ begin in segment iv.) two new pairs of dorsal setal bundles are produced. In most species of *Nais*, where the dorsal setæ begin in segment vi., no new bundles of dorsal setæ are produced in the newly formed head.

The prostomium is of the shape of a blunt equilateral triangle. There are no eyes.

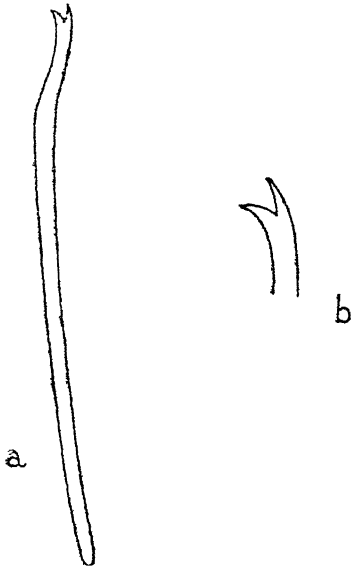
The ventral setæ begin in segment ii., and are relatively small; they have the usual form. In one of the Nigerian worms, taken as an example, the numbers of setæ per bundle were 4 or 5 in segments ii. and iii., 5 in iv., 6 in vi., 7 in vii., 6 or 7 in the middle of the body, and 5 further back; in other specimens also 7 was the largest number counted in any ventral bundle. In the most anterior segments the setæ are 53–65 μ in length (apparently rather a wide variability); the prongs are equal or nearly equal in length, the inner one being one and a half times to twice as thick at the base as the outer; the nodulus is at the middle of the length of the shaft or nearly so (slightly proximal, or very slightly distal). In the segments behind these the setæ are 60–62 μ in length; the prongs are unequal, the inner one and a half times as long as the outer and about twice as thick at the base; the nodulus is strongly distal (distal : proximal : : 2 : 3 or nearly so, or 3 : 4). In all the ventral setæ the curves of the shaft are rather gentle, the portion distal to the nodulus being almost straight.

There is thus, as often, a difference in type between the ventral setæ of the most anterior segments and those behind; but the difference is not great, and the transition seems to be gradual, not sudden, as in some species. It seemed to me that only the setæ of segments ii. and iii. had the nodulus at or near the middle of the shaft, and that it began to be distal in iv.; but the investigation by means of the oil-immersion of these details in the preserved worms is trying to the eyes, since the setæ are partly embedded in the body-wall, and rarely lie in one plane conveniently for examination.

In the specimens from Beira the ventral setæ are fewer per bundle, 4 or 5 (in one specimen only 3) in the anterior segments (ii.–v., those of the "head"), 4 or occasionally 5 or 3 behind this, diminishing to 2 at the hinder end. The setæ of the anterior bundles are 50–60 μ in length, the nodulus is at the middle of the shaft in those of segment ii., and even in segment iii. it becomes distal in position (distal : proximal : : 3 : 4 or 5 : 8). The setæ of the bundles behind these are fully as long as those of the anterior segments—up to 60 μ or slightly more; the nodulus is distal (distal : proximal : : 1 : 2). In all the bundles the prongs are about equal in length, the proximal being one and a half times as thick as the distal; the curves of the shaft are rather slight.

The dorsal bundles begin in segment iv., and consist of hair-setæ and needles—one or sometimes two of each. In the Nigerian worms the hairs, including the portion within the body-wall, do not surpass in length the diameter of the body (0·28 mm. or less); they are smooth in contour. The needles (fig. 2), 50–53 μ in length, are bifid, the two prongs being visible to the ordinary high power; examined by the oil-immersion lens the prongs are seen to be rather widely divergent, equal in length, the inner being one and a half times as thick as the outer; the shaft is almost straight, the distal fifth being bent backwards somewhat and slightly curved; the nodulus is placed at the junction of this distal portion with the rest of the shaft, and is therefore strongly distal (1 : 4).

Fig. 2.



Dorsal needle of *Nais bauchiensis.* *a*, whole seta, × 1500; *b*, distal end, × 3000.

In the specimens from Beira the hairs are 0·21 mm. in length—equal to or slightly greater than the diameter of the body; the needles are 46–52 μ long, and have the characters already described.

Chloragogen cells begin in segment vi. There appears to have been no stomachal dilatation of the alimentary canal, which, as will be described immediately, is in a very degenerate condition. There was no sign of a branchial fossa at the hinder end.

The dorsal vessel (seen in the Nigerian specimens) lies ventro-laterally on the left side of the body, or, towards the anterior end, makes a series of segmental loops on the left side of the alimentary canal before becoming finally dorsal. In the hinder segments, perhaps further forwards also, or even throughout the body, vessels, sometimes numerous, course over the inner surface of the body-wall. The blood is slightly yellow; it stains red with eosin, showing the presence of hæmoglobin.

None of the specimens examined showed sexual organs.

Note on the Harderian Glands.—These correspond to the lachrymal glands of higher vertebrates. According to Ecker and Gaupp's 'Anatomie des Frosches' the Harderian glands consist of branched tubes, which in part open independently in the anterior angle of the conjunctival sac, underneath the fold of the tendon of the nictitating membrane; mostly, however, they unite to form a fairly wide duct which enters the lower lid and discharges into the inner conjunctival space (within the nictitating membrane). The secretion moistens the surface of the bulb of the eye.

The Appearances in the Alimentary Canal.

The alimentary canal of *Nais bauchiensis*, as seen in worms mounted whole, varies in appearance in different specimens. In some examples the mouth was not seen at all, or was seen only with difficulty; in others, however, a definite mouth is to be seen in a side view. To take as an example a specimen from Beira, a rather narrow canal leads inwards from the mouth for a short distance to about the level of the setæ of segment ii., and then ends blindly, the portion of the alimentary tract immediately following being narrow and impervious; the tract then becomes thicker in the pharyngeal region (segments iii., iv., v.), but I could not make out any lumen (in this method of examination); in segment vi. possibly an irregular lumen, or a series of irregular spaces, is established, but there is no regular tubular lumen throughout the rest of the length of the worm.

Other specimens, from both Nigeria and Beira, were not unlike this one. In general terms, the mouth was usually either not to be made out, or was represented merely by a depression; the next portion of the tract was sometimes a thin impervious cord; the lumen of the canal throughout the anterior part, or sometimes through the greater portion of the body, was not continuous, but broken up into a series of vacuole-like cavities; the posterior portion of the canal was usually the clearest and might show a continuous lumen; but the anus was in most cases impervious, or, at least, an opening was not to be made out. Where the constitution of the walls could be discerned there did not seem to be a well-defined epithelial lining, and the lumen was sometimes filled with amorphous granular matter.

Specimens from both sources were also sectioned. It is not to be supposed that the histological condition of the worms was all that could be desired—certainly not as regards those from Beira. These, as mentioned above, were contained wholly within the Harderian glands, and the spirit would have to penetrate through the tissues of the frog before reaching them. The sectioned specimens of the Nigerian worms were taken from those which were hanging externally from the corner of the eye, and these would be more easily accessible to the spirit.

In the Nigerian specimens the alimentary canal is still pervious for considerable distances, both in the anterior, middle, and posterior regions of the body; but the lumen is very irregular and sometimes narrow—indeed, very narrow and almost thread-like for some distance; in longitudinal sections it often seems to be divided up by partitions, or to consist of a series of vacuole-like cavities. The walls of the canal are thin and much atrophied; the epithelium is, as a rule, very flat, or sometimes irregular; cells and débris may occupy the lumen; the peritoneal coat (chloragogen cells) is sometimes lacking, sometimes disintegrating. In a number of transverse sections the alimentary tube is absolutely not to be made out at all, and seems to have dissolved away entirely; in others the tract is represented by an indefinite aggregate of cells and débris.

The appearances are similar in the sections of specimens from Beira. Nearly everywhere the alimentary tract is narrow; in some places there is a lumen, in others none; where present it may be thread-like, 10μ in diameter or less; in some places it is blocked by cells and débris. No regular lining layer of epithelium was ever seen; frequently the cells were separating from the muscular layer and disintegrating. The chloragogen layer has undergone a great change; the cells are irregular in shape and size, often large, rounded, and containing a number of round granules which stain slightly with eosin; such cells have somewhat the appearance of sacs, empty except for the granules.

Not only the alimentary canal is degenerate; the cœlom contains degeneration products, derived probably from many sources. In the cavity are seen loose cells of various appearance; some, which may run together into masses, are large, round, or oval, with regular outline, granular homogeneous cell-body, and small round compact nucleus, not very unlike the disk-shaped corpuscles of certain Enchytræids; others have relatively less cytoplasm; some are mere naked nuclei, some non-nucleated fragments; there is also a quantity of débris, indefinite and indescribable, and some small aggregations of granules; in addition, fragments of muscle-fibres are seen.

Some of the nerve-cells appear as if being shed from the nerve-cord. The ventral vessel is often present as a large vessel; the parietal vessels are also cut in many places; the alimentary blood-sinus is frequently visible for long stretches. The setal sacs are present and well maintained, and often the septa also. The external epithelium and muscular coat of the body-wall are fairly well maintained.

Diagnosis.

A remarkable character of *Nais bauchiensis* is the beginning of the dorsal setal bundles in segment iv. I know of only one other species of the genus in which this is so—*Nais malayana*, from Kuala Lumpur, Malay Peninsula, described in a forthcoming paper of my own; indeed, the genus is always defined as having dorsal setæ beginning in segment vi., and the generic diagnosis will therefore have to be widened. In *Nais malayana* only four new segments (and a prostomium) are produced at the head of the posterior worm after fission (fragmentation); here the usual number (five) is produced, but of these five the two posterior (iv. and v.), contrary to the usual rule, develop dorsal as well as ventral setæ. From *N. malayana* the present species is immediately distinguished by the absence of the respiratory fossa at the hinder end of the intestine, which is a feature of the former worm, and gives it some resemblance to the various species of the genus *Dero*.

Parasitism in the Oligochæta.

While commensals (*Hystricosoma*, species of *Chætogaster* and a few other Naididæ, *Aspidodrilus*, *Fridericia parasitica*, *Haplotaxis intermedia*) and external parasites (*Enchytræus carcinophilus*, *Lumbricillus catanensis*, the Branchiobdellidæ) are rare among the Oligochæta, internal parasites are rarer still. It is true that there are many records of Enchytræids or Lumbricids having been found in the vomit, expectoration, urine, or fæces of man, or in discharges from fistulæ, etc. (Stiles and Hassall, '26 ; *cf.* also Stephenson, '30, p. 644) ; but is safe to say that these supposed cases of internal parasitism are due to the accidental presence of the worms in the vessels, or sometimes to their intentional introduction in order to excite interest or sympathy. The only real case of internal parasitism of an Oligochæte hitherto recorded seems to be that of *Schmardaella lutzi*, described by Michaelsen ('26) as inhabiting the ureters of the frog *Hyla venulosa*, from Maracay in Venezuela and Rio de Janeiro in Brazil.

It is interesting to note that in *Schmardaella lutzi* also the alimentary canal is very thin and narrow throughout, and impervious over long stretches; the chloragogen layer is enormously developed. Michaelsen, on the basis of the intestinal contents, suspects that the specimens from Rio may have derived their food from the host, but in those from Venezuela diatoms were found in the intestine. While it would apparently be possible for *Schmardaella lutzi* to descend from the ureters to the rectum of the frog, where it could obtain a certain amount of vegetable matter for food, and then to retreat again into the ureter, *Nais bauchiensis* seems to be restricted for nutriment to such animal fluids as it can absorb through the surface of its body. Perhaps its life in the Harderian glands is not a long one.

Degeneration of the Alimentary Canal in the Oligochæta.

A degeneration of the alimentary canal which is histologically very similar to that described above for *Nais bauchiensis* occurs at sexual maturity in species of *Dero,* in *Hæmonais*, in *Nais pectinata*, and possibly in some other Naididæ as well. The mouth closes (except in *Hæmonais*), the tract becomes narrow and impervious in places or contains irregular isolated cavities, and the lining epithelium degenerates ; the changes are more marked in the anterior portion of the tract.

Perhaps a closer parallel is to be found in *Stercutus niveus.* This worm was first obtained by Michaelsen ('88) from a heap of earth containing fish-manure, where its food consisted of the fluid and jelly-like decomposition products of the bodies of the fish. Here the whole alimentary tract is extremely narrow ; the epithelium of œsophagus and intestine is transformed into a loose network which fills the lumen, while the hinder end of the tract is represented by a solid cord of cells ; some yellow fæcal masses, which apparently can never be got rid of, occupy the hinder part of the intestine. It happened, however (Michaelsen, '89), that some of the fish-manured earth in which *Stercutus niveus* lived was emptied into a corner of the garden, where it was left; and after two years, during which time the medium in which the worms were living gradually became less heavily charged with nutriment, the worms had lost the peculiar characters of the alimentary tract; the gut epithelium now formed a continuous layer, and the anus became patent and gave exit to earthy fæces..

Life-history of Nais bauchiensis.

This is at present only a matter of conjecture. We have to ask whether all individuals of the species are parasitic or whether some also live freely. Is the alimentary canal complete at first, degenerating later, or is it impervious or otherwise degenerate from the first? Does the worm parasitize other species of *Phrynomerus* also? Does it parasitize only the Harderian glands, and how is it attracted? Does it reproduce itself in the frog, and, if so, how does it spread itself? To many of these questions the answers can only be tentative.

It is noteworthy, in the first place, that the same species of worm should be found parasitizing the same genus of frogs at two spots 2500 miles apart; doubtless these are not the only places where *Nais bauchiensis* occurs, and it has probably an extended distribution in the African continent. Secondly, from the fact that in the Nigerian specimens the head end is the one which is directed inwards, under cover of the eyelid, it would seem that the cluster of worms at the anterior canthus of the eye are working their way inwards; and the attraction can hardly be other than chemotactic in nature. Moreover, it seems impossible to suppose that, attached in the canthus of the eye, or ensconced in the Harderian glands, the worms can obtain nourishment in the ordinary way by the alimentary tract, or in any other way than by absorption through the surface of the body of such animal juices as surround it (or its anterior end).

I would suggest therefore that, after the manner of other species of the genus, *Nais bauchiensis* is for the most part a free-living worm which probably has a wide distribution in Africa. The secretion of the Harderian glands of certain frogs of the genus *Phrynomerus* has an attraction for the worms, and, in consequence, in places where these frogs occur, numbers of the worms gather at and near the point of the discharge of the secretion, and, pressing further inwards, work their way along the ducts of the gland or perhaps through the surrounding tissues, ultimately reaching the interior of the gland, destroying its structure, and occupying the capsule, which is left as a sac. Degeneration of the alimentary canal begins when the normal food ceases to be taken in and animal juices are absorbed through the surface; the worms are totally dependent on such juices from the time they attach themselves underneath the eyelid. How long the worms live in the Harderian gland is a matter of conjecture—possibly no long time. They probably do not reproduce either sexually or asexually in this situation; but, even if they did, the fact would have no importance, since the products would be unable to escape. The line, therefore, of all the individuals which become parasites comes to an end.

My best thanks are due to the authorities of the British Museum (Natural History) for the opportunity of investigating this exceedingly interesting worm, and for the facilities which they have placed at my disposal.

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XL.—*A new Trematode Parasite from the Domestic Goose.*

By M. NAZMI, M.R.C.S. (Eng.), L.R.C.P. (Lond.), Assistant Lecturer in Parasitology, Faculty of Medicine, Cairo.

WITENBERG (1929*a* & *b*) erected the genus *Cercarioides*, with the single species *C. aharonii*, from a marine bird, *Puffinus kuhli*. In spite of its external resemblance to some of the members of the family Strigeidæ (Holostomidæ), Witenberg rightly places this worm, on the ground of its internal morphology, in the family Heterophyidæ.

A second species of *Cercarioides* was recently found by the writer in the small intestine of a domestic goose in Cairo. This worm, of which, unfortunately, only a single specimen was obtained, closely resembles *C. aharonii*, but differs from it in its larger size and in certain small anatomical features.

Cercarioides baylisi, sp. n.

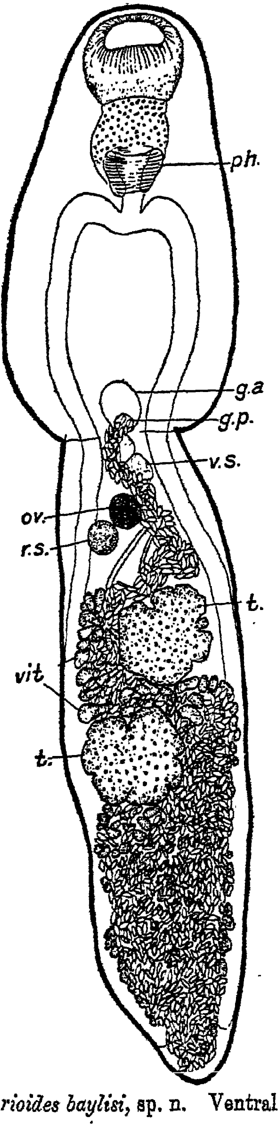
In the fresh state the worm is blood-red in colour, and was almost mistaken for a blood-clot. The body is 7·5 mm. long, the fore part being pear-shaped, with the broader end posterior, and measuring 3 mm. × 1·7 mm., while the hind part, which is separated from the fore-body by a well-marked constriction, measures 4·5 mm. × 1·25 mm. The fore-body is beset with flattened, posteriorly recurved spines, 0·02 mm. long and 0·005 mm. wide at the point where they are attached to the cuticle. Anteriorly there is a powerful subterminal oral sucker measuring 0·55 mm. in length and 0·73 mm. in width. Its opening measures 0·41 × 0·18 mm. Behind the sucker there is a large mass of glandular cells surrounding the prepharynx. This is followed by a powerful muscular pharynx, behind which is a very short œsophagus. The intestinal cæca run at first laterally and slightly anteriorly, then bend posteriorly and pass into the hind-body, where they run close to the margins until they end at about 0·26 mm. from the posterior end of the body.

The hind-body contains the genitalia, except for the genital pore, which is situated in front of the line of constriction. It bears a few slender spines 0·01 mm. long on its anterior part. The majority of these spines have probably been lost. The two testes, which lie diagonally about the middle third of the hind-body, are markedly lobulated and measure 0·75 mm. in diameter. Their vasa efferentia proceed anteriorly and to the left of the ovary to open into a vesicula seminalis 0·45 mm. long and 0·15 mm. wide, which is divided by a constriction about its middle into two parts. The ovary is 0·25 mm. in diameter, rounded and smooth, and is situated midway between the anterior testis and the genital pore. A receptaculum seminis of the same size and shape lies just behind and to the right of the ovary. The uterus occupies practically the whole area behind the posterior testis and the space between the two testes, finally running anteriorly to the right of the anterior testis and to the left of the ovary to open at a common genital pore 0·12 mm. in diameter. This pore is apparently the opening of a genital atrium which measures 0·33 × 0·27 mm.

The vitelline follicles are variable in size and shape, and are irregularly distributed medially to the intestinal cæca and between the testes. They extend forward as far as the anterior limit of the anterior testis on the right and that of the posterior testis on the left.

An excretory pore is present at the posterior end of the body. The ovum is 0·045 × 0·02 mm. in size, and possesses

Fig. 1.



Cercarioides baylisi, sp. n. Ventral view.

g.a., genital atrium; *g.p.*, genital pore; *ov.*, ovary; *ph.*, pharynx; *r.s.*, receptaculum seminis; *t.*, *t.*, testes; *vit.*, vitelline follicles; *v.s.*, vesicula seminalis.

a thick shell, with an operculum at one pole and a minute knob at the other. It is of a yellowish-brown colour, and appears to contain a miracidium.

The knob at the lower pole of the ovum is similar to that of the ovum of *Heterophyes heterophyes*, and should be considered as a distinctive feature of at least some, if not all, of the members of the family Heterophyidæ. Unfortunately, no stress has been laid in the literature on this knob.

Fig. 2.

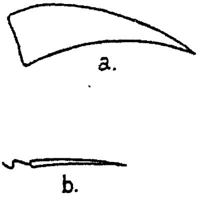
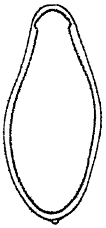


Fig. 3.



Cercarioides baylisi, sp. n.

Fig. 2.—*a*, spine on fore-body; *b*, spine on hind-body.
Fig. 3.—Ovum.

Comparative Table of Measurements and Characters of C. baylisi *and* C. aharonii.

	C. baylisi.	*C. aharonii.*
Length of body	7·5 mm.	3·4 mm.
Fore-body spines	Long and thick, 0·02×0·005 mm.	Long and thin.
Hind-body spines......	Short and thin, 0·01 mm. long	Short and thick.
Glandular mass round prepharynx.	Present.	Absent.
Testes...............	0·75 mm. in diameter and equal.	Unequal. Posterior testis 0·38 mm. in diameter.
Ovary	0·25 mm. in diameter.	0·18 mm. in diameter.
Receptaculum seminis..	Present.	Absent (?).
Seminal vesicle........	0·45×0·15 mm.	0·15×0·09 mm.
Ovum................	0·045×0·02 mm.	0·037×0·022 mm.

The study of this worm has been carried out at the British Museum (Natural History), and it is named after Dr. H. A. Baylis, whom I wish to thank for his kind assistance.

The type-specimen is in the writer's private collection.

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XLI.—*On a small Collection of* Blattidæ *and* Gryllidæ *from Tahiti.* By L. Chopard.

The Orthoptera composing this small collection were collected by Miss L. E. Cheesman during the year 1925 in the Society Islands, and are deposited in the British Museum. The species are few in number, but several of them are interesting as being previously known only from the original description.

Cutilia nitida, Br.—Tuamotus, Fakarava, ii. 25, 2 ♀. Among dead leaves in a tree-hole. (St. George Exp.)

Cutilia soror, Br.—Tahiti: N. Raiatea, vi. 25, 1 young ♀. Beaten out of bracken at 1500 ft.

These two species of *Cutilia* are widely distributed over the Oceanic region.

Temnopteryx bimaculata, Chop.—Tahiti, Lake Vaihiria, vii. 25, 1 ♀, in a tree-hole; N. Raiatea, v. 25, 2 ♀; Hitiaa, Bora Bora, nr. Papeete, 9. iv. 25, several larvæ.

This species was previously known from New Caledonia only; compared with a cotype in the Paris Museum collections, the specimens from Tahiti agree perfectly; the female, which was not described, is a little larger than the male, but closely resembles it in other respects.

Gryllus oceanicus, Le Guill.—Tahiti: nr. Papeete, iv. 25, 2 ♂, 2 ♀; Papenoo, iii. 25, 2 ♀; N.E. Raiatea (sea-level), vi. 25, 1 ♀.

The commonest *Gryllus* of the Oceanic region. Extremely numerous all over the islands visited.

Speonemobius tigrinus, Sauss. (*Nemobius tigrinus*, Saussure, Mem. Soc. Genève, xxv. p. 91, 1877).—Tahiti, 4. viii. 25, 3 ♂, 7 ♀. Numerous on coral-protected beaches close up to the tide-line, living under stones etc., and coming out at sundown.

This species shows the characteristics of the genus *Speonemobius* in the armature of the posterior tibiæ, having five apical spurs, three external spines, and two internal ones only. The female, which was hitherto unknown, is completely apterous, with a rather long straight ovipositor, with apical valves narrow, acute, and completely smooth.

Its light brown coloration, varied with whitish spots, somewhat reminds one of a very small *Gryllomorpha.*

The genus *Speonemobius* was previously known only from a cavernicolous species found in India (*cf.* Chopard, Rec. Ind. Mus. xxvi. p. 84, 1924).

Liphoplus novaræ, Sauss. (Mém. Soc. Phys. et d'Hist. Nat. de Genève, t. xxv. p. 315, 1876–77).—Tahiti : Papeete, 25. iii. 25, 2 ♂, 2 ♀, several larvæ ; Raiatea, v. 25, 1 ♀ ; Bora Bora, vi. 25, 2 ♀.

Always to be found sheltering in the leaf-buds of *Hibiscus tiliaceus*, with only the long antennæ visible. Never seen inland. Taken only on shore-belt.

Rhicnogryllus tahitensis, Sauss. (*Trigonidium tahitense*, Saussure, *t. cit.* p. 465, 1878).—Tahiti : S.E. Raiatea, Vallée Vaiurumai, vi. 25, 1 ♂, 1 ♀ ; N. Raiatea (1000 ft.), 1 ♂, 2 ♀.

This small species agrees perfectly with the genus *Rhicnogryllus*, Chop. ; in the original description Saussure insisted on the strong projecting veins of the elytra, this feature being the chief characteristic of this genus.

Var. *decorus*, var. nov.—Similar to the typical form, but much less uniform in coloration ; head with two small brown bands along the antennal sockets, converging towards the frontal rostrum ; pronotum with disc adorned with small brown spots ; lateral lobes presenting also a dark band, more or less developed, and a few small piliferous spots.

Lateral field of the elytra brown. Posterior femora with three small light brown spots towards the base, in the middle, and before the apex.

Type.—Tahiti, N. Raiatea (1000 ft.), v. 25, 1 ♀ ; in British Museum.

This small Gryllid is rather different from the typical *R. tahitensis*, but only in its coloration, the characters of the elytral venation and the general shape being exactly the same ; it is evidently only a variety of this species. In addition to the type several other specimens were obtained : Tahiti : Hitiaa (1500 ft.), vii. 25, 6 ♀ ; Tautira Valley, Vaitephiha, viii. 25, 1 ♂.

The last three species have been described from specimens from Tahiti, but *Liphoplus novaræ* has also been found on other Pacific Islands, especially Fiji and Samoa ; the other two species are at present known only from Tahiti.

XLII.—*The Evolution of the Primates.*

By C. TATE REGAN, D.Sc., F.R.S.

THE Primates are placental mammals, generally with an insectivorous or frugivorous dentition, mostly arboreal, typically with opposable pollex and hallux and flat nails, and with a complete postorbital bar. In addition, the early formation of a complete allantoic chorion appears to be diagnostic.

Two main divisions are generally recognized—Lemuroids, with smaller brain, orbits open behind, and diffuse non-deciduate placenta, and Anthropoids, with larger brain, orbits closed, and discoidal deciduate placenta. There is no general agreement as to *Tarsius*, but the modern tendency is to place it in a separate suborder, connecting the Lemuroids with the Anthropoids. Max Weber, for example, gives the following classification of the Primates :—

LEMUROIDEA	Lemuriformes. Lorisiformes.
TARSIOIDEA.	
ANTHROPOIDEA ...	Platyrrhina. Catarrhina.

Some authorities (Matthew, Gregory) have expressed the opinion that the Anthropoidea may be diphyletic. The reasons for this view, apart from the fact that the Platyrrhines and Catarrhines are very different in structure, are as follows :—

Platyrrhines inhabit Central and South America, and as fossils are known only in South America, dating back to the Miocene. Catarrhines inhabit Africa and southern Asia ; as fossils they are known in Africa at the beginning of the Oligocene, and in Europe and Asia from the Miocene onwards. Lemuroids are abundant in the Eocene of Europe and North America, but no Anthropoids. Therefore it seems probable that the Platyrrhines originated in South America and the Catarrhines in Africa, and that the two groups have nothing to do with each other.

Thornton Carter's researches on the microstructure of the enamel of the teeth of the Primates show that in the Eocene Adapidæ and the Madagascar Lemurs (Lemuriformes), and in the Catarrhina, the enamel prisms have straight edges and are separated by a small amount of interstitial substance, but that in the Asiatic and African Lemurs (Lorisidæ), the Eocene *Hemiacodon*, *Tarsius*, and the

Platyrrhines, the prisms have wavy edges and are separated by a larger amount of interstitial substance. In my opinion this investigation is decisive, and I propose to classify the Primates as follows :—

Suborder 1. LEMUROIDEA :
Adapidæ, Lemuridæ, Indrisiidæ, Archæolemuridæ, Chiromyidæ.

Suborder 2. LORISOIDEA :
Omomyidæ, Lorisidæ.

Suborder 3. TARSIOIDEA :
Necrolemuridæ, Tarsiidæ.

Suborder 4. PLATYRRHINA :
Cebidæ, Hapalidæ.

Suborder 5. CATARRHINA :
Parapithecidæ, Cercopithecidæ, Colobidæ, Hylobatidæ, Simiidæ, Hominidæ.

The relationships may be indicated by a diagram (p. 385), in which the groups having enamel prisms with wavy edges are placed on the left.

The Adapidæ, Omomyidæ, and Necrolemuridæ are Eocene families. The Adapidæ and Omomyidæ are known from the Eocene of both Europe and North America, but the genera are different in the two continents. Evidently both Lemuroidea and Lorisoidea date back to Cretaceous times, and at the end of the Cretaceous, when it is supposed that all the continents except Australia became united, had an opportunity to become widely distributed. This was probably the time when Lemuroids entered Madagascar from Africa and Lorisoids invaded South America. During the Eocene, when the continents were isolated, Lemuroids gave rise to Catarrhines in Africa *, Lorisoids to Tarsioids in Europe and to Platyrrhines in South America. Alternative possibilities are that the continent formed by the union of Africa and South America, which probably was not broken up

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* Wallace ('Island Life') considers the Madagascar fauna to be derived from an ancient African fauna. The island separated from Africa before the groups now inhabiting that continent developed, or entered from Eurasia. The presence of Lemuroids in Madagascar is evidence that Adapidæ, or nearly related forms, were present in Africa in Eocene times. The Lemuroids of Madagascar parallel the Marsupials of Australia; these also are representatives of an ancient and primitive group, formerly widely distributed, but now nearly extinct except in the isolated island where they have survived and developed.

until late Cretaceous times, was the original home of the Lemuroids and Lorisoids, or that the ancestors of the Platyrrhines did not enter South America until the end of the Oligocene, at which time many authorities think North and South America became connected. Matthew, however, says that no interchange of mammals between these two continents took place from the end of the Cretaceous until the Pliocene.

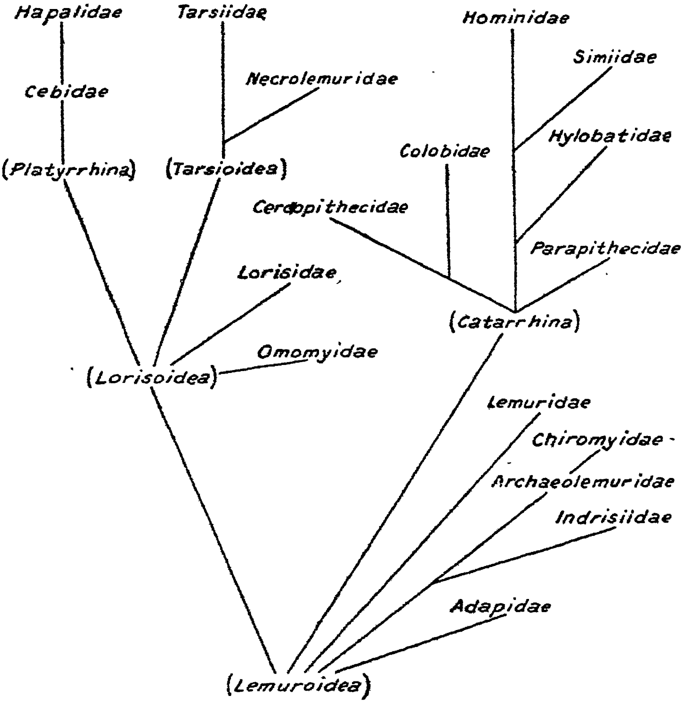

Diagram showing relationships of the suborders and families of the Primates.

The Lemuroids have the orbits open behind, the tympanic annular and enclosed within the bulla, and enamel prisms with straight edges. This group includes the Adapidæ of the Eocene of Europe and North America, and the Madagascar Lemurs. The Adapidæ (*Pelycodus*, *Notharctus*, *Pronycticebus*, *Adapis*) are the most generalized Primates known, and are near the basal stock. Their dental formula is $\frac{2.1.4.3.}{2.1.4.3.}$; the incisors and canines are normal and the molars are large; the last lower molar has a posterior cusp and in lateral view appears to have three ridges. The Madagascar families are distinguished from the Adapidæ by various specializations of the dentition.

The Lorisoids differ from the Lemuroids in that the tympanic forms part of the outer wall of the bulla, and the enamel prisms have wavy edges. The Lorisidæ include the Lorisinæ and Galaginæ; they resemble the Lemuridæ in their dentition, having the lower incisors and canines slender and procumbent, forming a scraper, and the lower first premolar canine-like. This resemblance has been held by some authorities (*e.g.*, Winge) to indicate a direct relationship between these families, but in my opinion is due to parallel evolution. In this connection it is interesting to compare two closely related genera of the Indrisiidæ—*Palæopropithecus* and *Indris*,—one with lower incisors normal and erect, the other with them styliform and procumbent. In the Eocene of North America and of Europe occur the Omomyidæ. The more generalized members of this family have a dentition not unlike that of the Adapidæ, except that the premolars number three instead of four. In one of these (*Hemiacodon*) Carter has found that the enamel prisms have wavy edges. From such a type the Lorisidæ may be descended, and it may not be far from the ancestors of the Tarsioids and Platyrrhines.

Tetonius, from the Eocene of North America, may be related to the Omomyidæ. The dentition is highly specialized, with a gap behind the large pair of teeth in the front of each jaw. The snout is short and the orbit is large, but there does not seem to be any other resemblance to *Tarsius*.

The characters that distinguish *Tarsius* from the Lorisoids are the partial closure of the orbits, the tubular meatus, the extension of the outer pterygoid lamina on to the side of the bulla, the union of the tibia and fibula, and the discoidal deciduous placenta. Only the first and last of these could be considered as leading to the Platyrrhines; but the partial closure of the orbits in *Tarsius* is evidently related to their enormous size. The words "discoidal and deciduous" merely conceal the fact that the placenta of *Tarsius* is quite different from that of the Platyrrhines in form and in structure. It is conical and prominent, not discoidal and sessile; the chorion, instead of being completely vascularized, as in all other Primates, is vascularized only in the placental area; the trophoblast, according to J. P. Hill, is unique, both in its histological characters and its behaviour. The dental formula of *Tarsius* is $\frac{2.1.3.3.}{1.1.3.3.}$. As compared with Lorisoids and Platyrrhines it has lost a lower incisor.

Necrolemur, from the Eocene of Europe, has been very fully described by Stehlin. It has the same number of teeth as *Tarsius*, but Stehlin gives it the dental formula $\frac{2.1.3.3.}{0.1.4.3.}$, for the reason that whereas in *Tarsius* the first lower tooth is smaller than the second, in *Necrolemur* the first lower tooth is large and the second is very small. The snout is moderately long and the orbits are not particularly large; the general form of the skull is as in *Galago* rather than as in *Tarsius*. The postorbital bar is formed as in *Galago*, and the mastoid is swollen as in the Lorisidæ. But there is a tubular meatus formed as in *Tarsius*, the outer pterygoid lamina extends on to the bulla in the same way as in that genus, and a tibia and fibula united together, found in the same deposits, probably belong to *Necrolemur*.

Thus, in the Eocene there were in existence animals with many Lorisoid characters, but with certain Tarsioid specializations, tubular meatus, fibula reduced and united with tibia, not more than one lower incisor, etc.

It is customary to diagnose the Tarsioidea by the characters of *Tarsius*, but to include the Omomyidæ in the group. If only the Necrolemuridæ and Tarsiidæ be included the suborder is a natural and well-defined one, closely related to the Lorisoidea, and not ancestral to any other group.

The Platyrrhines and Catarrhines are generally grouped together as Anthropoidea, but the development of a discoidal deciduous placenta and an increase in size of the brain are not very strong evidences of relationship. As already stated, the Platyrrhines have the enamel-pattern of the Lorisoids, the Catarrhines that of the Lemuroids.

J. P. Hill states that the well-marked differences in the behaviour of the trophoblast and the structure of the placenta in the Platyrrhines and Catarrhines suggest the conclusion that the Platyrrhines separated very early from the parent stem to pursue a path of their own. This is my conclusion, but instead of assuming that an ancestral Eocene monkey existed in Asia or North America, I think that for a common ancestor of the two groups we must go back to the primitive Lemuroids that gave rise to the Eocene Adapidæ and Omomyidæ.

In the more primitive Platyrrhines the brain is relatively small and has few sulci; it is not very different from Lemuroid and Lorisoid brains. More advanced Platyrrhines have a larger brain with more numerous sulci, and therefore approximate to the lower Catarrhines in brain structure. These developments within the Platyrrhine group are interesting as showing how a Lemuroid brain may have evolved into a Catarrhine one.

According to Winge[*] the closure of the orbits is a direct result of the increased size of the brain. The expansion of the anterior part of the brain-case forces the temporal muscle to find new attachments; consequently the membrane between the orbit and the temporal fossa ossifies. But it is clear that this ossification has taken place independently and in different ways in the two groups. In all the Platyrrhines, except two highly specialized genera, the malar extends back to the parietal and forms nearly the whole of the outer wall of the orbit. In *Brachyteles* the squamosal meets the frontal, excluding the malar from contact with the parietal. In *Alouatta* the enormous hyoid bulla alters the shape of the skull, which is depressed; the frontals extend outwards and downwards and sometimes meet the alisphenoids, but the shape of the malar, and the fact that it may still have a short contact with the parietal, make it clear that this arrangement is a modification of the more primitive one. In the Catarrhines the frontal meets the alisphenoid, and both bones as a rule form a considerable part of the lateral wall of the orbit, but to a less extent in the Hylobatidæ than in any others; the suture of the malar with the frontal and alisphenoid often appears, in lateral view, to run nearly vertically downwards from the thickened margin of the orbit[†].

In the Catarrhines, as in the Lemuroids, the pollex is opposable and is widely separated from the other digits. In the Platyrrhines the pollex is not, or scarcely, opposable, and is close to the next digit.

In the Platyrrhines the tympanic is as in the Lorisoids; in the Catarrhines it forms a long meatus.

The dentition of the Catarrhines is readily derived from that of the Adapidæ by the loss of two premolars. Typically the palate and tooth-rows are long, the molars are large, and the third lower molar has a posterior cusp. In spite of the presence of three premolars the Platyrrhine dentition is more specialized; the palate and tooth-rows are shorter, the molars are relatively small, the third upper molar is reduced, and the third lower is similar in size and structure to the second.

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[*] I am indebted to Mr. M. A. C. Hinton for a translation of Winge's work on the Primates, which is of great interest. Winge discusses adaptation, the modification of the muscles and skeleton of limbs and backbone in relation to climbing, the meaning of such differences as those between the jumping Galaginæ and the slow-climbing Lorisinæ, etc., etc.

[†] Forsyth Major (Proc. Zool. Soc. 1901, i. pl. xiii.) illustrates the supposed progressive restriction and pushing back of the parietal from the Lemurs to the higher Monkeys, at first by the malar, next by the frontal and alisphenoid, lastly by the squamosal.

The most primitive Platyrrhine known is *Aotus*, which has retained the nocturnal habits and retinal structure of its Lorisoid ancestors. There is a wide communication between the orbit and the temporal fossa, the orbital margins are thin, the dorso-lumbar vertebræ are numerous (22) and primitive in structure, and the brain is relatively small and has few sulci. Although *Aotus* is a Platyrrhine, it is almost a Lorisoid.

On the other hand, *Parapithecus*, from the Lower Oligocene of Egypt, is a Catarrhine with Lemuroid characters. Only the lower jaw is known, but the high coronoid process, the narrow symphysis, and the divergent tooth-rows make it clear that this belonged to an animal far more Lemuroid than any other known Catarrhine.

I submit that the study of the structure of the known recent and extinct Primates establishes the phylogeny outlined above. No one with any experience of the problems of classification will consider that there is any improbability in the parallelism required. The series Adapidæ–Omomyidæ–Cebidæ, and Adapidæ–Parapithecidæ–Cercopithecidæ may nearly represent the stages in the evolution of the Platyrrhines and Catarrhines. There appears to be a rather close parallelism in the evolution of the brain, and a less close one in the evolution of the placenta; in the closure of the orbits the parallelism is inexact. In other respects, *e.g.*, enamel-pattern, dentition, structure of the hand, the series are divergent.

Elliot Smith divides the Primates into four suborders—Lemuroidea, Tarsioidea, Pithecoidea, and Anthropoidea—which he considers to be successive stages in an evolutionary series. The Pithecoidea include the Platyrrhines, and the Cercopithecidæ and Colobidæ; the Anthropoidea comprise the rest of the Catarrhines. Within the Pithecoidea the Platyrrhines are considered to be ancestral to the Catarrhine monkeys. Of the enamel-structure characteristic of the Lemuroidea (*s. s.*) and Catarrhina, Elliot Smith suggests "that the tendency towards the emergence of this character was held in check as man's ancestors passed through the Tarsioid and Platyrrhine phases, and emerged again only when the Catarrhine phase was reached." This suggestion seems to me rather desperate.

Elliot Smith claims that his classification is decisively corroborated by J. P. Hill's Croonian Lecture of Dec. 7, 1929, of which only an abstract is yet available. Hill certainly recognizes four stages in the adaptive specialization of the Primate placenta, which he names Lemuroid, Tarsioid, Pithecoid, and Anthropoid. The Platyrrhines and Catarrhine monkeys have reached the Pithecoid stage, but Hill says "The existence of certain well-marked differences in the behaviour of the trophoblast and in the structure of the placenta in the two groups of monkeys, and the very striking similarities in the development of the placenta in the Catarrhines [Cercopithecidæ, Colobidæ] and the Anthropoids [Hylobatidæ, Simiidæ, Hominidæ] suggest the conclusion that the Platyrrhines separated very early from the parent stem to pursue a path of their own, whilst the Catarrhines furnished the stock from which the Anthropoids originated."

To anyone familiar with the principles of classification Hill's words will suggest that the Platyrrhines and Catarrhines (including the Anthropoids) are well defined and natural groups, and that the suborder Pithecoidea is artificial.

Elliot Smith gives an illustration of the manner in which the facts of comparative anatomy support his classification. He states that in the Tarsioidea, Pithecoidea, and Anthropoidea the dorsal nucleus of the lateral geniculate body is expanded and differentiated, whereas the ventral nucleus diminishes and eventually disappears. In the Lemuridæ and Lorisidæ, however, he says that the ventral nucleus is hypertrophied and the dorsal is insignificant.

So far as I can judge from the literature, Elliot Smith stands alone in this interpretation of the structure of the lateral geniculate body of the Lemuridæ and Lorisidæ.

It appears that in the Primates the main part, often the whole, of the lateral geniculate body contains medium-sized or large nerve-cells, which are more or less definitely arranged in laminæ, a structure generally considered to be characteristic of the dorsal nucleus. In some forms a small ventral nucleus, characterized by scattered cells of smaller size, may be present. Of the Lemuridæ *Chirogale* has a distinct ventral nucleus, but *Lemur* has not. Of the Lorisidæ *Perodicticus* has a ventral nucleus, but *Galago* and *Nycticebus* have not. Le Gros Clark says that the ventral nucleus of *Tarsius* is much better developed than in the generality of the Primates. Környey compares the dorsal nucleus of *Lemur* with that of the Anthropoid Apes ; in both these are two ventral laminæ, each formed of 3 to 5 rows of large cells; in both there lie above these the medium-sized cells.

Enough has been said to show that it is not usual, nor indeed justifiable, to interpret the lateral geniculate body of the Lemuridæ and Lorisidæ as widely different from that of other Primates in having an insignificant dorsal and a hypertrophied ventral nucleus. On the contrary, it appears that to the characters diagnostic of the Primates may be added:—Dorsal nucleus of lateral geniculate body large, more or less definitely laminated, with large and medium-sized cells; ventral nucleus small or absent, when present with small scattered cells.

Elliot Smith also refers to the new researches on the eye and brain, and the well-known evidence provided by the muscles and skeleton, which establish that the Catarrhines must have passed through stages now known only in the living Platyrrhines. This method of stating his case is less definite; it may be admitted that certain Platyrrhine genera, too recent and too specialized to be ancestral to the Catarrhines, approximate, some in one feature, some in more, to Catarrhine structure; but this is of no more value as evidence of relationship than are the prehensile tails of some Platyrrhines, or the compressed and pointed nails of others, as evidence against it.

Elliot Smith's diagram suggests that he does not restrict the word "Platyrrhine" to a group defined by the characters common to the known members, but extends it to include hypothetical extinct forms, supposed to be ancestral to these and to the Catarrhines. He gives the time and place of their origin as "before the close of the Eocene" and "somewhere in the neighbourhood of Central America." He says that those "which wandered across the Atlantic, seem to have undergone a profound change during their journey"! ('Evolution of Man,' 1926).

A "Platyrrhine" ancestral to the Catarrhines should have, presumably, most of the characters of *Aotus*, with a generalized discoidal placenta, hands probably as in the Cercopithecidæ, and jaws and dentition much as in *Parapithecus*, but with an additional præmolar. It is difficult, however, to assign an enamel-pattern to this imaginary hybrid; which type should be patent, and which latent?

No paper on the evolution of the Primates can be concluded without reference to Man. In my scheme *Tarsius* and *Homo* are at the ends of two lines that began to diverge in Cretaceous times. In all his characters Man is a Catarrhine, and is a member of that branch of the Catarrhines which includes also the Gibbons and the Anthropoid Apes.

Winge points out that the Simiidæ, with their strong teeth and jaws, restricted ethmoid and reduced nasals, and interorbital space compressed unless it is widened by an extension of the frontal sinus, are less primitive than *Hylobates* and *Homo*, and thinks that *Homo* evolved from an ape somewhat similar to *Hylobates*, but not so specialized.

My own studies on the ethmoid and turbinate bones lead to a somewhat similar conclusion, but I think the Simiidæ left the human line later than the Hylobatidæ, and that the Chimpanzee, which is far less specialized than the Gorilla and Orang, has not departed very far from it. But I doubt whether Man's ancestors walked on their knuckles, as the Simiidæ do.

SHORT LIST OF MEMOIRS ON PRIMATES.

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Madagascar Lemurs.—Standing, Trans. Zool. Soc. xviii. (1908).

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Brain.—Kükenthal und Ziehen, Jenaisch. Zeitschr. xxix. (1895); Elliot Smith, Trans. Linn. Soc. viii. (1903); Trans. Zool. Soc. xviii. (1908); Cat. Brains Roy. Coll. of Surgeons (1902).

Lateral Geniculate Body.—Le Gros Clark, Journ. Anat. lxiv. (1930); Környey, Arbeit. Neurologisch. Inst. Wien, xxx. (1928); Woollard and Beattie, Journ. Anat. lxi. (1927).

Distribution.—Matthew, Bull. Amer. Mus. xxii. (1906).

XLIII.—*A new Genus allied to* Beræa, *Stephens* (*Trichoptera*). By M. E. MOSELY, F.E.S.

[Plate XIII.]

THE discovery of a new genus allied to *Beræa* provides an occasion for the consideration of the whole group.

McLachlan, in his 'Monographic Revision and Synopsis of the Trichoptera of the European Fauna,' hinted that the genus would probably, at some future date, require subdivision.

Wallengren, in 1891, created three subgenera—*Beræa*, to take *pullata*; *Ernodes*, to take *articularis*; and *Dophnia*, to take *maurus*.

In his account of *Beræa*, written in Swedish, he bases his subgenera mainly on obscure characters of neuration, which are all the more difficult to follow owing to his adoption of a Swedish system of notation that does not conform to that used by McLachlan.

Martynov, in 1913, raised *Ernodes* to full generic rank on the discovery of several new Caucasian species of the *articularis* group.

His contribution to the question is written in Russian and consequently not easily available to the majority of Trichopterists.

He finds his generic characters in the presence or absence of a callosity at the base of the anterior wing, the formation of the head and thorax, the form of the joints of the maxillary palpi, neuration, and details of the genitalia.

No attempt has been made since McLachlan's Monograph to deal with the *Beræa* problem in either the English, French, or German languages.

At present there would seem to be no adequate reason for the separation of *pullata,* to which may be added *dira,* from the *maurus* group (*maurus, aureomarginata,* and *pallida*), but there is a very homogeneous group of the *articularis* type, and the erection of *Ernodes* to full generic status is both convenient and desirable.

With this subdivision the European and Asiatic Beræinæ will contain five genera:—

BERÆA, Stephens (*pullata, dira, maurus, aureomarginata, pallida*) *.

QUARELIA, Martynov (*rostrata*).

BERÆAMYIA, gen. nov. (*squamosa,* sp. n.).

ERNODES, Wallengren (*articularis, vicina, nigroaurata, palpata, saltans,* and *digitata*).

BERÆODES, Eaton (*minuta*).

In all the genera the spur formula is 2 . 2 . 4.

Beræa may be distinguished by the occurrence, in the ♂, of minute scales, perhaps androconia in either the anterior, posterior, or both wings (Pl. XIII. figs. 5 and 6) (discernible in some species only under a comparatively high-power objective), by the normal form of the joints of the maxillary palpi, and by the presence of a callosity, in the ♂ sex only, at the base of the anterior wing.

This callosity varies in form in the different species. In *pullata* it appears as a somewhat lightly chitinized cover, through which may be dimly seen a thimble-shaped process covered with long, probably specialized hairs.

In *dira* it is reduced to a mere tuft of long black hairs. In the *maurus* group the callosity is fully developed and densely covered with short, erect, and very black, thick, seed-like scales, set on end and packed tightly together to form a jet-black mat.

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* *Beræa valirana,* Navás, is a *Micrasema minimum,* McL.

Quarelia would appear to be very closely allied to *Beræa*. According to Martynov there is, in the ♂, a basal callosity to the anterior wings, a spur to the basal joint of the antenna (a character present also in two species of *Beræa*, namely *pullata* and *dira*), and the joints of the maxillary palpi are normal. I am unacquainted with its single species *rostrata*, and unable to say in what way the genus differs from *Beræa* other than in the very pointed and narrow wings shown in the figure accompanying its description (in Russian).

Beræamyia, gen. nov.: in the ♂ there is a dense covering of reddish-brown scales to the anterior wings, with microscopic seed-like androconia present in certain areas. There are three longitudinal folds in the anterior wing, the longest situated in the middle and extending from a basal callosity nearly to the apex; the second and third folds are found on each side towards the base of the central fold, and extend to about a third of its length. The callosity at the base of the anterior wing is developed into a long spatula-like process; there is no spur to the basal joint of the antenna, and the joints of the maxillary palpi are normal.

Beræamyia is evidently more closely allied to *Beræa* than to the other genera in the Beræinæ, and is remarkable for the dense clothing of scales on the anterior wing and the unusual development of the callosity.

Ernodes in the ♂ has no basal callosity on the anterior wings, no scales or androconia, no spur to the basal joint of the antenna, and the third joint of the maxillary palpi is abnormal, being very long and angularly bent towards its base. It is difficult to find many positive characters, but its spur formula—2 . 2 . 4—and general arrangement of neuration prove its affinity to the other genera in the Beræinæ.

Beræodes in the ♂ carries a pencil of hairs towards the base of the anterior wings. The insect is minute in size, and both wings are very narrow and pointed. So far only the one species *minuta* is known.

I have avoided the use of characters based on neuration, as this would entail creating separate genera to take *pullata* and *dira*, which, until more species akin to them are discovered, seems unnecessary. Moreover, neuration in *Beræa* is very unstable.

For the same reason in the genus *Beræa*, I have disregarded as a generic character, the spur or tooth to the basal joint of the antenna, as this spur is present only in the two species *pullata* and *dira*. No doubt the time will come when the genus *Beræa* will require further subdivision, in which case the spur may well be regarded as a character to separate *pullata* and *dira* from the other species of the genus.

I must not omit to thank Dr. B. P. Uvarov, who kindly translated for me portions of Martynov's Russian descriptions, and also Dr. Bo Tjeder who performed a like service in respect to Wallengren's Swedish account of the genus.

Family **Molannidæ**.

BERÆAMYIA, gen. nov.

Spurs 2 . 2 . 4. Other generic characters have been detailed above.

Genotype, *Beræamyia squamosa*, sp. n.

Beræamyia squamosa, sp. n.

(Pl. XIII. figs. 1–4; text-figs. 1–5.)

Head.—Black, clothed with black hairs; antennæ black, with black hairs, basal joint long, without tooth or spur; palpi black, very hairy; at vertex, between antennæ, is a double wart covered with black hairs.

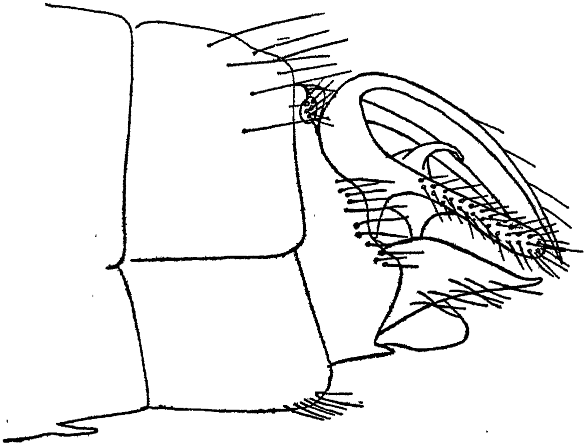
Wings.—Anterior black, densely closed with black hairs intermingled with reddish-brown scales (Pl. XIII. fig. 4); there is a longitudinal fold across middle of wing from basal callosity nearly to apex, obliterating most of neuration in centre of wing; a second fold, much shorter, arises from below callosity, and a third in a corresponding situation above it (Pl. XIII. fig. 1); neuration can be best understood by reference to figure (Pl. XIII. fig. 3); callosity, is developed into a long spatula-shaped process; between it and membrane of wing are microscopic seed-like scales (Pl. XIII. fig. 2). Similar scales are found intermingled with the pubescence in the wings of *Beræa pullata*, mainly in the fold of the posterior wing (Pl. XIII. fig. 5). Posterior wing black, with black hairs but no scales.

Legs.—Yellowish brown, with black hairs.

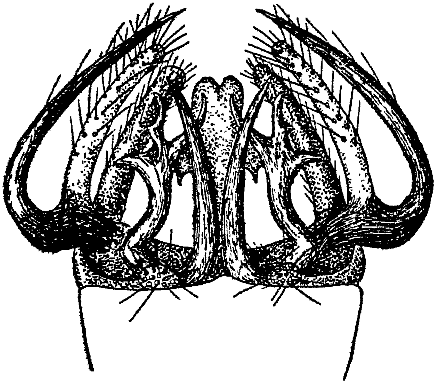
Abdomen.—Black.

Genitalia (♂) (text-figs. 1–2).—Superior appendages very small, scarcely projecting beyond margin of last dorsal segment; from centre of margin of this segment proceeds upper penis-cover (?) consisting of two long, strongly chitinized processes, broad at base, commencing parallel to each other, then widely diverging, apices acuminate; intermediate appendages bifurcate, upper branch strongly chitinized, curving downward on to lower branch like the tine of a pitch-fork, lower branch membranous, dilated at apex, clothed with strong black hairs; inferior appendage from the side, stout at base, becoming abruptly acuminate; from above finger-shaped; penis consists of a fleshy lobe excised at apex; penis-sheaths very complicated; they bear some resemblance to a stag's antlers, inner branches supporting and guiding the long spine-like upper penis-cover; there appear to be four branches to each sheath; in middle of last ventral

Text-fig. 1.



Text-fig. 2.

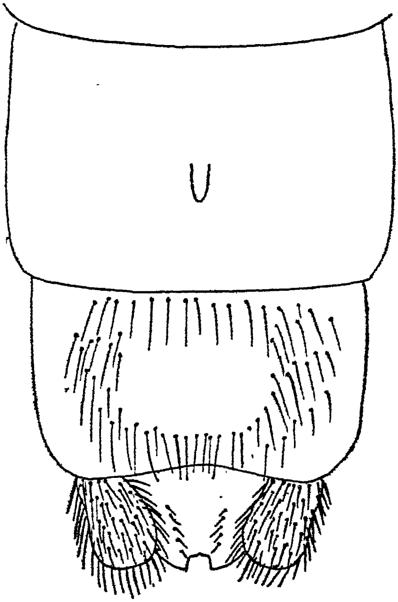


Beræamyia squamosa, ♂.

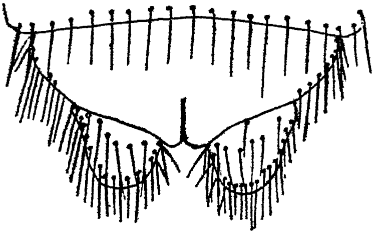
Fig. 1.—Genitalia from the side.
Fig. 2.—Genitalia from above.

segment is a projection from sides of which margin of segment falls away in shallow excisions; projection itself has a double excision along upper margin; there is a finger-shaped process on seventh ventral segment and a fringe of strong hairs on eighth.

Text-fig. 3.



Text-fig. 4.



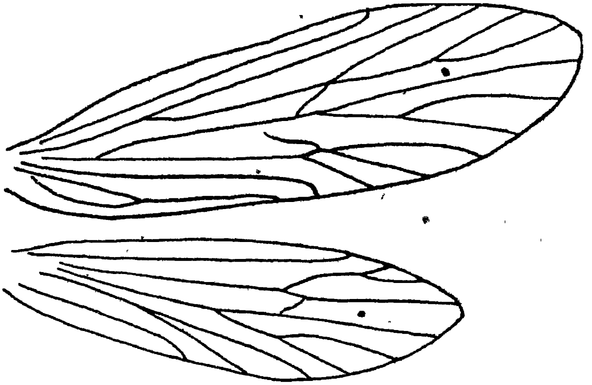
Beræamyia squamosa, ♀.
Fig. 3.—Genitalia from beneath.
Fig. 4.—Genitalia from above.

Genitalia (♀) (text-figs. 3–4).—Terminal segments as in all ♀ species of the Beræinæ rather difficult to make out; last dorsal segment triangular, with slight cleft at apex; from beneath this two rounded lobes project beyond margin towards the sides, apparently connected to it by a membranous plate;

margin of last ventral segment slightly concave, centre portion of segment swollen, pale, and fringed with strong black hairs; penultimate segment carries a strong tooth.

Length of body, ♂, 5 mm.; expanse 14 mm.
" " ♀, 4½ mm.; " 13½ mm.

Text-fig. 5.



Beræamyia squamosa, ♀, neuration of wings.

France, Alpes-Maritimes, Cagnes, 9. vi. 1928; Basses-Pyrénées, St. Jean-Pied-de-Port, 28. vi.–3.vii.1929. ♂ type is a balsam preparation in the author's collection; paratypes, ♂ and ♀, in the author's and British Museum collections.

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EXPLANATION OF PLATE XIII.

Fig. 1. *Beræamyia squamosa*, ♂. Neuration of wings (denuded).
Fig. 2. Ditto. Androconia beneath callosity, much enlarged.
Fig. 3. Ditto. Callosity, enlarged.
Fig. 4. Ditto. Portion of anterior wing showing scales, enlarged.
Fig. 5. *Beræa pullata*, ♂. Portion of posterior wing much enlarged, to show androconia.
Fig. 6. *Beræa maurus*, ♂. Subcostal area of anterior wing much enlarged, to show androconia.

XLIV.—*The Ethiopian Representatives of the Genus* Galesus (*Proctotrupoidea*), *with Descriptions of new Species.* By G. E. J. NIXON.

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THE present paper is based mainly on material collected by Mr. R. E. Turner in South Africa, and presented by him to the British Museum, in which the types of all new species herein described are contained.

GALESUS, Hal.

Curtis, Brit. Ent., Hymen. vol. iii. (no. 341).

The characters of the genus may be briefly summarized as follows:—

Frons with two to five projections or teeth, its surface between the anterior ocellus and the prominence on which the antennæ are inserted almost perpendicular. Face horizontal or oblique, on both sides with a deep, broad, longitudinal furrow. Mandibles long, toothed, directed backwards and prolonged into the form of a beak. Maxillary palpi 5-jointed, labial palpi 3-jointed. Antennæ 14-jointed in the ♂, 12-jointed in the ♀. Scape apically with two lateral lamellæ, which partly conceal the pedicel. Parapsidal furrows (notauli) always present, divergent anteriorly. Scutellum with two large pits anteriorly, a narrow longitudinal groove on each side, and with two or more smaller pits on its posterior margin (according to Kieffer rarely only the two anterior pits present). Wings without distinct venation, apically either with or without an excision, in life longitudinally folded as a rule. Legs with the femora and tibiæ apically clavate. Abdomen basally with a longitudinal medial sulcus.

Type of the genus, *Galesus fuscipennis*, Hal.

Distribution.—Palearctic, Nearctic, Neotropical, Indian, and Ethiopian regions.

Kieffer divides this genus into two subgenera—*Galesus* (sensu str.) and *Schizogalesus* (André, Spec. Hym. Eur. v. 10, p. 832)—which he distinguishes as follows:—

Second joint of funicle of ♂ shorter than first. Notauli widened posteriorly, where they are separated from each other by about their own breadth. Wings, as a rule, longitudinally folded or excised at their apex ……	*Schizogalesus.*
Second joint of funicle of ♂ longer than first. Notauli posteriorly separated from each other by about two to three times their own breadth. Wings seldom longitudinally folded or excised at their apex…… .. ……………………	*Galesus.*

The species herein described would appear to fall within the subgenus *Schizogalesus*, which, in its applicability to the Ethiopian species at present known, may be further diagnosed as follows:—

Anterior margin of frons always with two pairs of projections, the external and internal. The internal projections are sometimes not defined as such, but their position is always determined by the anterior limit of the carinæ, which extend forwards from the posterior ocelli. Occiput always margined, so that the head behind is sharply truncated. Notauli usually much dilated posteriorly, where they are as wide as the adjacent scutellar hollows, and form with these a continuous channel of equal depth throughout. Scutellum always with at least five hollows, which, however, seldom offer specific peculiarities. Sulcus of second tergite usually extending about one-third to one-half the length of the segment.

In the following keys, *G. conradti*, Kieff., is omitted, this species, unfortunately, not being represented in the collection of the British Museum; its description, however, is given.

Females.

1. Antennal prominence produced and deeply notched, so as to appear armed with two or more teeth ... 2.
   Antennal prominence unarmed; at the most feebly emarginate .... 3.
2. Antennal prominence armed with two teeth, ninth joint of funicle not, or hardly, thicker than third; head not longer than broad .... *bidens*, sp. n.
   Antennal prominence armed with four teeth; ninth joint of funicle considerably thicker than third; head much longer than broad .... *quadridens*, sp. n.
3. First two joints of funicle and perhaps also the third, above, smoother and much more shining than following joints. Head behind the eyes with several large punctures arranged more or less in a row .... *inquisitor*, sp. n.
   First two joints of funicle otherwise .... 4.
4. Antennal club 3-jointed, very distinct .... *distinctus*, sp. n.
   Antennal club with more than three joints, *or* not distinct .... 5.
5. Area in front of anterior ocellus conspicuously flat and more or less rectangular; its anterior margin quite straight .... *rectangularis*, sp. n.
   Area in front of anterior ocellus not rectangular; its anterior margin strongly produced forwards and forming an angulation .... 6.
6. Notauli dilated posteriorly, where they are as wide, or nearly so, as the adjacent scutellar hollows anteriorly .... 8.
   Notauli of nearly equal width throughout and certainly not as wide posteriorly as the adjacent scutellar hollows anteriorly .... 7.
7. Vertex with two somewhat ill-defined raised lines, which arise from between the posterior ocelli and the eyes and converge towards the occipital margin; head strongly narrowed behind and not longer than broad .... *abdominalis*, sp. n.
   Vertex without such raised lines; head nearly parallel-sided and longer than broad .... *longiceps*, sp. n.
8. Lateral margins of frons continued backwards as a carina, or at least as a complete row of punctures posteriorly, round behind the eyes to as far as the genal line .... 12.
   Lateral margins of frons not thus continued ...... 9.

9. Second tergite, at least on its apical half, and especially on its deflexed portions apically, conspicuously punctate. Fifth joint of funicle evidently nearer in width to sixth than to fourth, so that a well-developed 6-jointed club is formed . *magnificus*, sp. n.
   Second tergite impunctate; at the most with inconspicuous, mostly setigerous punctures apically; fifth joint of funicle intermediate in width between sixth and fourth, so that no 6-jointed club is formed ... . 10.
10. Shortest distance between the eyes and the occipital margin not greater than shortest width of the eyes themselves; sixth joint of funicle evidently nearer in width to seventh than to fifth, so that a 5-jointed club is formed .... *modestus*, sp. n.
   Shortest distance between the eyes and the occipital margin somewhat greater than the shortest width of the eyes themselves; sixth joint of funicle intermediate in width between fifth and seventh, so that no 5-jointed club is formed ... 11.
11. Vertex not longitudinally carinate .... *turneri*, sp. n.
   Vertex longitudinally carinate throughout its entire length .... *turneri*, var. *carinaticeps*, var. n.
12. Apical half of second tergite conspicuously punctate, the punctures shallow and not all setigerous .... *muscidorum*, Dodd.
   Second tergite impunctate; at the most with inconspicuous, mostly setigerous punctures on its apical fourth .... 13.
13. Legs entirely red or yellowish red; at least the pedicel reddish; often first four joints of funicle entirely red .... *silvestrii*, Kieff.
   Legs with at least the coxæ and femora black; pedicel and funicle without red coloration ...... *difficilis*, sp. n.

Males.

1. Antennal prominence produced and armed with four blunt teeth; sometimes it appears only weakly trisinuate; legs mostly black .... *quadridens*, sp. n.
   Antennal prominence, if produced, at the most emarginate .... 2.
2. Antennal prominence produced and somewhat deeply emarginate. Second to twelfth joint of funicle cylindrical, thickly clothed with pale adpressed hairs, and contrasting strongly with the much shorter, shining black pedicel .... *bidens*, sp. n.
   Antennal prominence hardly produced, and at the most, very feebly emarginate .... 3.
3. Wings apically unexcised .... 4.
   Wings apically excised, or at any rate notched ... 7.
4. Lateral margins of frons continued backwards, as a carina, round behind the eyes to as far as the genal line; legs entirely red .... *silvestrii*, Kieff., var *nigricornis*, var. n.
   Lateral margins of frons not thus continued ...... 5.
5. Apical two-thirds of second tergite densely punctate. *punctulatus*, Kieff.
   Second tergite impunctate; at the most with inconspicuous setigerous punctures at its apex; head longer than broad .... 6.

6. Vertex not longitudinally carinate .... *turneri*, sp. n.
Vertex longitudinally carinate throughout its entire length .... *turneri*, var. *carinaticeps*, var. n.
7. Lateral margins of frons continued backwards, as a carina, round behind the eyes to as far as the genal line .... 8.
Lateral margins of frons not thus continued ...... 10.
8. Apical two-thirds of second tergite conspicuously punctate, the punctures closer and more conspicuous on the deflexed portions of the tergite . *muscidorum*, Dodd.
Second tergite impunctate; at the most with inconspicuous, mostly setigerous punctures......... 9.
9. Legs entirely red; funicle reddish .... *silvestrii*, Kieff.
Legs black; funicle black .... *difficilis*, sp. n.
10. Funicle conspicuously reddish .... *rectangularis*, sp. n.
Funicle black .... 11.
11. First joint of funicle longer, and above smoother, and more shining than any of those joints following; head behind the eyes usually with several large punctures arranged more or less in a row .... *inquisitor*, sp. n.
First joint of funicle without such a combination of characters; head behind the eyes without large punctures .... 12.
12. Vertex with two somewhat ill-defined raised lines, which arise from between the posterior ocelli and the eyes and converge towards the occipital margin; head strongly narrowed behind and not longer than broad .... *abdominalis*, sp. n.
Vertex without such raised lines; head not much narrowed behind, and longer than broad .... *longiceps*, sp. n.

Galesus quadridens, sp. n.

♀. Black. Mandibles reddish towards their apex. Legs with the tibiæ and tarsi red, the coxæ and femora nearly black.

Head: considerably longer than broad, narrow, nearly parallel-sided. Width across the eyes about equal to that of the thorax. Shortest distance between the eyes and the occipital margin almost twice as long as the shortest width of the eyes themselves. Frons: external projections long and acute; behind each of the internal projections there is a sharp tooth; the margin in front of the anterior ocellus straight, the distance between its mid-point and the ocellus slightly less than diameter of ocellus. Antennal prominence: strongly produced beyond the antennal insertions and armed with four teeth, the two inner ones short and blunt, the two outer ones very long and sharp, slightly divergent. Antennæ: scape apically with two sharp teeth; pedicel shining and coarsely sculptured; funicle considerably, but gradually, thickened towards its apex; first joint one and a half times as long as wide, sculptured very much as is the pedicel; fourth and fifth slightly longer than broad; joints 6–9 more or less transverse. Mandibles very long and curved.

Thorax: somewhat narrowed and flattened. Wings apically deeply excised.

Abdomen: second tergite rather narrow, impunctate.

Length: 3·3–3·8 mm.

♂. Legs nearly black, except tarsi, which are reddish.

Head: distinctly though not conspicuously narrowed behind, and but little longer than broad, the shortest distance between the eyes and the occipital margin being equal to, or a little longer than, the shortest width of the eyes themselves. Frons: projections as in ♀. In front of the anterior ocellus there is no straight margin; the frons slopes almost perpendicularly from the ocellus down to the antennal insertions; the intervening space is often quite smooth, its surface not always broken by carinæ extending from its mid-point to the internal projections. Antennal prominence: less developed than in ♀, rectangularly produced and armed with four blunt teeth of equal length; sometimes the teeth are so blunt that it appears only weekly trisinuate. Antennæ: scape as in ♀; pedicel half as long as first joint of funicle; funicle somewhat coarsely sculptured; first joint twice as long as wide; second slightly produced on its lower side, in length about equal to third; joints 3–11 cylindrical, twice as long as wide.

Thorax: less flattened than in ♀ and not noticeably narrowed. Wings apically with or without an excision.

Abdomen: second tergite less narrowed than in ♀.

Length: 3·5 mm.

Natal (Van Reenen, Kloof); Orange Free State (Harrismith); Zululand (Gingindhlova).

Characterized by the development of the antennal prominence, which in the ♀ is a striking feature.

Galesus bidens, sp. n.

♀. Black. Mandibles sometimes reddish towards their apex. Legs red or brownish red; coxæ and femora darker.

Head: broader than long, not much narrowed posteriorly; shortest distance between the eyes and the occipital margin about as great as the shortest width of the eyes themselves. Frons: its margin between the internal projections sometimes straight, but usually with a small medial obtuse angulation. Antennal prominence: projection on which antennæ are inserted strongly produced and deeply emarginate, so as to be armed with two long stout teeth, whose outer side appears arched at the actual point of the antennal insertion. Antennæ: scape distally armed with two strong teeth; pedicel shining, shorter than first joint of funicle; funicle hardly thickened towards its apex; ninth joint not, or hardly, wider than third; first about twice as long as its greatest width; second shorter than first; fourth and fifth a little longer than broad; joints 6–9 as long as broad; tenth twice as long as broad.

Thorax: mesonotum strongly arched anteriorly. Areæ of propodeum roughly sculptured. Wings apically excised. Scutellum subconvex, with a weak longitudinal ridge.

Abdomen: second tergite impunctate except for the usual fine, inconspicuous, and mostly setigerous punctures towards its apex.

Length: 2·8–3·5 mm.

♂. *Head*: rather more transverse than in ♀, the shortest distance between the eyes and the occipital margin being sometimes considerably less than the shortest width of the eyes themselves. Antennal prominence less strongly produced, seen from above, appearing only rather deeply emarginate, the two rounded teeth formed, evenly curved on their outer side. Antennæ: pedicel black, smooth, and shining, half as long as first joint of funicle; funicle pale, owing to its thick clothing of pale adpressed hairs, and contrasting strongly with the pedicel; first joint twice as long as its greatest width; joints 2–11 cylindrical, twice as long as wide, slightly decreasing in length and breadth towards apex of funicle.

Length: 3·2–3·5 mm. Otherwise like the ♀.

Cape Province (Mossel Bay).

Characterized in both sexes by the emarginate antennal prominence and also in the ♀ by the filiform funicle.

Galesus inquisitor, sp. n.

♀. Black. Tarsi and apex of tibiæ reddish.

Head: slightly longer than, or as long as, broad; hardly narrowed posteriorly. Shortest distance between the eyes and the occipital margin greater than the shortest width of the eyes themselves. Face behind the eyes usually with several large punctures, which are arranged more or less in a row. Frons: its margin between the internal projections parallel with the occipital margin. This margin on each side of the well-developed blunt medial tooth is represented by two high ridges, which, when seen from above, form a slight angle at their junction with this tooth. Area in front of the anterior ocellus more or less flat. Antennæ: scape apically with three blunt teeth; seen from in front, the pedicel and first two joints of funicle, and perhaps also the third, smooth and strongly shining, clothed with long scattered hairs; these joints contrast strongly with those following, which in comparison appear quite dull; first joint of funicle about twice as long as wide, a little longer than pedicel; second not much longer than wide; third and fourth nearly moniliform; fifth nearer in size to sixth than to fourth; sixth wider than fifth; joints 5–9 more or less transverse, with the tenth forming a strongly thickened 6-jointed club.

Thorax: notauli rather broad throughout, posteriorly as wide as the adjacent scutellar hollows where they touch these. Scutellum subconvex. Wings apically excised.

Abdomen: second tergite with numerous fine scattered unsetigerous punctures over its entire dorsal surface.

Length: 3·5–4 mm.

♂. Differs from ♀ only in following respects:—

Head: as broad as long, sometimes slightly transverse. Shortest distance between the eyes and the occipital margin about equal to the shortest width of the eyes themselves. Frons: sometimes the margin between the internal projections does not run parallel with the occipital, but is produced forward and forms an obtuse angulation. Antennæ: pedicel smooth and shining, more than half as long as first joint of funicle; first joint of funicle about twice as long as its greatest width, strongly curved on its lower side, smoother and more shining than any of the following joints, and clothed with long erect scattered hairs; second shorter than first, produced on its lower side; joints 3–11 about one and a half times as long as broad.

Thorax: wings usually apically excised, sometimes only notched.

Length: 3·3–4 mm.

Cape Province (Mossel Bay, Aliwal North, Port St. John, Ceres); Natal (Van Reenen, Kloof); Orange Free State (Harrismith).

This species is rendered very distinct by the sculpture of the funicle.

Galesus distinctus, sp. n.

♀. Black. Pedicel and first seven joints of funicle reddish. Legs in greater part reddish.

Head: as broad as long. Vertex just before its posterior margin somewhat abruptly, though not conspicuously, narrowed. Eyes behind nearly surrounded by a row of very shallow impressions of irregular shape. Vertex with two large punctures on each side, situated close to its posterior margin. Frons: seen from above rectangular; its anterior margin quite straight; its external projections appear right-angled, and, together with the straight margin joining them and the carinæ which extend from them to the posterior ocelli, form a rectangle on whose imaginary basal line the anterior ocellus would stand. This median area of the frons bears a weak longitudinal carina. Antennæ: scape without apical teeth; pedicel cylindrical, thicker than first joint of funicle and twice as long as wide; first joint of funicle not much longer than wide; second to sixth moniliform, subequal in length and breadth; seventh slightly thicker than sixth; joints 8–10 much thicker than the preceding, forming a conspicuous 3-jointed club, of which the first and second joints are about as long as wide; the third, one and a half times as long as the preceding joint.

Thorax: mesonotum strongly arched anteriorly. Notauli of nearly equal width throughout and posteriorly not as wide as the adjacent scutellar hollows where they touch these. Areæ of propodeum with much rough sculpture.

Abdomen: second tergite rather swollen, once and two-thirds as long as broad; basal sulcus short, hardly longer than width of petiole.

Length: 2·5 mm.
Cape Province (Mossel Bay). 1 ♀.
Characterized by the 3-jointed antennal club.

Galesus rectangularis, sp. n.

♀. Black. Mandibles reddish towards their apex. Legs in greater part red, coxæ darker or black.

Head: about as long as broad, posteriorly not much narrowed. When the head is seen from above, the space between the eyes and the occipital margin appears straight or gently rounded. Frons: external projections blunt, nearly right-angled; seen from above, the margin joining the internal projections is straight, and, together with the carinæ which extend from these projections to the posterior ocelli, encloses a flat, horizontal, more or less rectangular area. This area appears free, and is raised well above the level of the external projections. Antennæ: pedicel thicker and slightly longer than first joint of funicle; first joint of funicle not quite one and half times as long as its greatest width; second slightly shorter than first; third and fourth slightly longer than wide or moniliform; fifth nearer in size to sixth than to fourth; joints 5–9 transverse, considerably thicker than the preceding joints, with the tenth, forming a 6-jointed club.

Thorax: normal. Wings apically excised.

Abdomen: second tergite impunctate, except for the usual inconspicuous setigerous punctures towards its apex.

Length: 2·5–2·8 mm.

♂. Pedicel and funicle entirely reddish; basal joints of funicle slightly paler.

Head: as broad as long, not strongly constricted behind, the temples rounded. Frons: margin between the internal projections medially angulate; median area flat except for a small depression behind this medial angulation. Antennæ: pedicel two-thirds as long as first joint of funicle; funicle somewhat shining; first joint slightly curved beneath, one and two-thirds as long as its medial width; second widest in middle, as long as first; remaining joints about one and a quarter times as long as wide.

Thorax: wings with a slight notch.

Length: 2·5 mm.

4 ♀ ♀, 1 ♂. Cape Province (Mossel Bay, Port St. John).

The ♀ of this species is characterized by the shape of the median area of the frons. The ♂ is very like that of *silvestrii*, Kieff., from which, however, it is readily distinguishable by the absence of a carina round the eyes.

Galesus abdominalis, sp. n.

♀. Black. Pedicel reddish apically. Legs red, except for the coxæ, femora, and hind tibiæ, which are nearly black.

Head: as long as broad, posteriorly strongly narrowed and somewhat rounded. Frons: medial projection well developed; median area not differing materially from that of *silvestrii*, Kieff. Between the anterior ocellus and the paired ocelli there is a transverse ridge, and behind this, lying between the posterior ocelli, is another, shorter one. Vertex: from a point midway between the posterior ocelli and the eyes there arise, apparently as a continuation of the outer lateral margins of the frons, two raised lines, which converge towards the occipital margin; these raised lines are anteriorly quite distinct, but posteriorly become somewhat ill-defined, and on each of them, a little before they reach the occipital margin, lies a deep pit. Antennæ: pedicel a little longer than wide, thicker than first joint of funicle; funicle gradually thickened towards its apex; first joint nearly two and a half times as long as its greatest width; second and third subequal in length, about one and a half times as long as wide; fourth and fifth but little longer than wide; sixth to ninth more or less transverse; tenth a little shorter than first.

Thorax: notauli rather shallow, very little widened posteriorly and not as wide as the adjacent scutellar hollows where they touch these. Scutellum: between the tegulæ and the large anterior hollows is a narrow longitudinal groove of irregular outline, whose posterior end lies very close to the anterior end of the large lateral grooves. Wings apically excised.

Abdomen: petiole twice as long as wide. Second tergite long, narrow, rather more than twice as long as broad; basal sulcus forked almost at its inception, and continuing as two shallow, though rather wide, furrows to about the middle of the segment; these furrows diverge very slightly and apically become indistinct and irregular in outline. On each side of the dorsal surface of the second tergite there extends from near the base to about two-thirds of its length a faint band of extremely shallow confluent punctures of irregular shape, giving the abdomen the appearance of having been slightly scratched along each side.

Length: 4 mm.

♂. Differs from ♀ only in the following respects:—Antennæ: entirely black; pedicel slightly more than half as long as, and thicker than, first joint of funicle; funicle smooth and rather strongly shining; first joint nearly two and a half times as long as its greatest width; second joint twice as long as wide, slightly curved beneath; third hardly shorter than second; joints 4–11 gradually decreasing in length, about one and a half times as long as wide.

Abdomen: petiole two and a half times as long as wide.

Length: 4 mm.

Cape Province (Port St. John).

A very distinct species, characterized at once by the sculpture of the vertex and the forked abdominal sulcus.

Galesus magnificus, sp. n.

♀. Black. Mandibles red towards the apex. Legs obscure red; coxæ and femora sometimes darker.

Head: about as broad as long; very little narrowed posteriorly; shortest distance between the eyes and the occipital margin less than the shortest width of the eyes themselves. Eyes not surrounded with a carina. Frons with a sharp medial tooth, and with its median area resembling that of *silvestrii*, Kieff. Antennæ: scape apically with three teeth; pedicel shining, more than half as long as first joint of funicle; funicle strongly thickened apically, its first three joints more roughly sculptured than those following; first joint slightly less than twice as long as its greatest width; second, one and a quarter to one and a half times as long as wide; third slightly shorter than second; fourth slightly thicker than third and as long as wide; fifth as long as wide, nearer in size to sixth than to fourth; joints 6–9 transverse; fifth to tenth forming a well-developed 6-jointed club. Mandibles rather long. Vertex with four somewhat indistinct punctures, two on each side, situated near its posterior margin.

Thorax: lateral lobes of mesonotum slightly depressed. Areæ of propodeum smooth and shining. Wings apically excised.

Abdomen: second tergite conspicuously punctate over its apical half or two-thirds; these punctures are larger and more numerous on the deflexed portions of the segment.

Length: 4·2 mm.

2 ♀♀. Cape Province (Port St. John); Natal (Kloof).

Characterized by the absence of a carina round the eyes and by the punctate abdomen.

Galesus modestus, sp. n.

♀. Black. Tegulæ posteriorly reddish. Legs reddish, coxæ and femora sometimes darker.

Head: slightly transverse, rather strongly narrowed behind; shortest distance between the eyes and the occipital margin less than the shortest width of the eyes themselves. Frons: lateral margins of the acute external projections continued backwards to a point on a level with the posterior margin of the eyes; median area of the frons as in *silvestrii*, Kieff. Antennæ: pedicel slightly more than half as long as first joint of funicle; funicle not strongly thickened towards its apex; first four joints narrow, cylindrical, equal in width; first joint nearly three times as long as wide, narrower than pedicel; second and third subequal in length, nearly twice as long as wide; fourth and fifth a little shorter than third, but fifth slightly thicker than fourth; sixth nearer in size to seventh than to fifth, though not conspicuously so; joints 6–9 distinctly longer than wide, forming with the tenth a weakly-developed 5-jointed club.

Thorax: lateral lobes of mesonotum slightly depressed. Areæ of propodeum smooth and shining, the carinæ dividing them all clearly defined. Wings apically excised.

Abdomen: second tergite impunctate, less than twice as long as broad.

Length: 3–3·5 mm.

2 ♀ ♀. Cape Province (Port St. John).

Characterized by the narrow, cylindrical, basal joints of the funicle.

Galesus turneri, sp. n.

♀. Black. Legs in greater part red, coxæ sometimes darker.

Head: longer than broad, very strongly but gradully narrowed posteriorly; the shortest distance between the eyes and the occipital margin distinctly greater than the shortest width of the eyes themselves. The occipital margin forms a sharp ridge and is entirely free from an edging of punctures. Frons: external projections small, acute; median area of frons formed by the same arrangement of carinæ as in *silvestrii*, Kieff., but differing much in aspect; the frons medially is rather strongly produced forwards, its middle projection represented only by the point of the acute angulation formed by the carinæ which extend from the internal projections; these two carinæ are high and well developed, and seen from the side appear nearly straight; the ocelli are situated well back on the vertex, so that this median area appears somewhat longer than wide and exposes a smooth, conspicuously large surface, which is in great part quite flat. Vertex strongly convex in the region of the ocelli. Cheeks with a conspicuous tuft of pale hair. Antennæ: pedicel about one and a half times as long as wide; funicle gradually thickened towards its apex; first joint nearly three times as long as its greatest width; second about two-thirds as long as first; third a little shorter than second, rather more than one and a half times as long as wide; fourth thicker than third, distinctly, though not much longer than wide; fifth intermediate in size between fourth and sixth; joints 5–9 more or less moniliform; tenth nearly twice as long as ninth; apical six joints all rather strongly separated.

Thorax: lateral lobes of mesonotum rather strongly depressed. Sides of scutellum posteriorly often quite straight, lateral grooves often abbreviated and their posterior limits not clearly defined. Propodeum with a well-developed, conspicuous ʎ-shaped carina. Wings apically excised.

Abdomen: petiole in comparison with second tergite very narrow. Second tergite impunctate, broad, about one and three quarters as long as wide, medially strongly convex, apically somewhat flattened.

Length: 4–4·2 mm.

♂. Pedicel red. Otherwise like the ♀ in colour.

Head: less long than in ♀; the frons less developed; the internal projections not clearly defined; the carinæ which enclose the median area less pronounced. Antennæ: pedicel half as long as first joint of funicle; funicle rendered pale by the adpressed pubescence which clothes it; its sculpture obscured; first joint basally narrowed, nearly three times as long as its greatest width; joints 2–11 cylindrical; second two and a half times as long as wide; remaining joints decreasing slightly in length to the eleventh.

Thorax: wings apically unexcised.

Length: 4 mm.

Cape Province (Mossel Bay, Port St. John).

Galesus turneri, var. *carinaticeps*, var. n.

♀. Differs from typical *turneri* as follows:—Vertex with a sharply defined longitudinal carina, which extends from the anterior ocellus to the occipital margin. Upper half of fore wings when folded thickly clothed with blackish pubescence, and contrasting rather strongly with the paler, only normally pubescent, lower half.

♂. Like the ♀, but the wings evenly pubescent all over. The antennæ differ slightly from those of typical *turneri*, in that the joints of the funicle do not decrease in length towards its apex, though there is a marked decrease in their width.

Cape Province (Mossel Bay). 1 ♀, 2 ♂♂.

The long posteriorly narrowed head and the form of the antennæ render this species very distinct in the typical form. The carinate vertex is a striking feature of its variety.

Galesus longiceps, sp. n.

♀. Black. Mandibles reddish towards their apex. Legs in greater part black; trochanters, intermediate and front tibiæ, and tarsi reddish.

Head: nearly parallel-sided, considerably longer than broad; the shortest distance between the eyes and the occipital margin nearly twice as long as the shortest width of the eyes themselves. Frons: external projections long, acute, slightly divergent; a tooth behind each of the internal projections. Antennæ: scape distally with two teeth, its lateral lamellæ two-thirds its own length; pedicel two-thirds as long as first joint of funicle; funicle gradually thickened towards its apex; first joint twice as long as its greatest width; second and third subequal in length, two-thirds as long as first; fourth a little shorter than third and slightly thicker; fifth intermediate in width between fourth and sixth, a little longer than sixth; joints 6–9 slightly transverse. Mandibles very long. Occipital margin of head evenly edged with punctures.

Thorax: rather strongly flattened. Notauli of nearly equal width throughout, posteriorly not as wide as the adjacent scutellar hollows where they touch these.

Abdomen: second tergite long, narrow, impunctate.

Length: 3·5 mm.

♂. *Head*: shorter than in ♀, as long as broad, slightly narrowed behind; shortest distance between the eyes and the occipital margin about equal to the shortest width of the eyes themselves. Frons: external projections not strongly produced, nearly right-angled; ocelli placed far forward; surface of frons between the anterior ocellus and the medial projection almost perpendicular. Antennæ: pedicel two-thirds as long as first joint of funicle; funicle somewhat roughly sculptured; first joint narrower than the following, one and two-thirds as long as its greatest width; second a little shorter than first, widest in the middle; joints 3–9 cylindrical, decreasing slightly in length and width; all about one and a half times as long as wide.

Thorax: not markedly flattened.

Abdomen: second tergite long, narrow, with many unsetigerous punctures on its apical dorsal fourth.

Length: 3·8 mm.

Cape Province (Port St. John, 1 ♀; Mossel Bay, 1 ♂).

Characterized by the shape of the head, which in the ♀ is a very striking feature.

Galesus silvestrii, Kieff.

Boll. Laborat. Zool. Portici, v. 7, p. 91 (♂ ♀) (1913).

♀. Black. Pedicel and first four joints of funicle reddish or sometimes the same colour as the legs. Legs entirely bright red or reddish yellow.

Head: slightly transverse, posteriorly strongly constricted. Frons: its anterior margin seen from above with an acute medial tooth; this tooth is situated much lower down on the frons than the internal projections, and viewed from the side forms the apex of a longitudinal keel, which extends down the vertical surface of the frons to as far as the antennal insertions; from this medial tooth run two sharp ridges to the internal projections, and from thence run two others to the posterior ocelli; the area thus enclosed is evenly concave, and its anterior margin forms an acute angulation. Antennæ: pedicel brighter in colour and more shining than first joint of funicle; first joint of funicle nearly twice as long as wide; second considerably shorter than first; third but little longer than wide; fifth nearer in size to sixth than to fourth; joints 5–9 more or less transverse, much thicker than preceding joints, and together with the tenth forming a 6-jointed club. Lateral margins of frons continued backwards as a carina round behind the eyes to as far as the genal line; posteriorly this carina is margined on its inner side with large puncture-like impressions, separated by short costæ. Vertex often with four punctures, two on each side.

Thorax: normal. Propodeum with its areæ smooth and shining. Wings apically excised.

Abdomen: Second tergite virtually impunctate; at the most with inconspicuous setigerous punctures towards its apex.

Length: 2·5-3 mm.

♂. Differs from the ♀ only in the antennæ, which, with exception of the scape, are brownish red or reddish, the pedicel and first few joints of the funicle paler as a rule; pedicel more than half as long as first joint of funicle; funicle somewhat smooth and shining; first joint nearly twice as long as its greatest width; second slightly shorter than first, beneath weakly carinate for about two-thirds of its length, the joint widest at the point where this carina ends; joints 3–11 about one and a half times as long as wide.

Length: 2·5-3 mm.

S. Nigeria (Olokomeji, parasite of *Ceratitis anonæ*, Graham). Gold Coast (Aburi, parasite of *Ceratitis nigerrima*, Bezzi). Dahomey (Kotomou, parasite of *Ceratitis giffardi*, Bezzi). Cape Province (Mossel Bay, Worcester); S.W. Africa (Okahandya).

This species is characterized in both sexes by the entirely bright red legs and by the carina surrounding the eyes.

Galesus silvestrii, var. *nigricornis*, var. n., ♂.

Distinguishable from typical ♂ by the following characters:—

Funicle darker, nearly black, less shining than in typical *silvestrii*; somewhat roughly sculptured, joints 3–11 nearly twice as long as wide. Wings apically without an excision.

Cape Province (Mossel Bay). 4 ♂ ♂.

Galesus silvestrii, var. *robustior*, Silv.

Boll. Laborat. Zool. Portici, v. 8, p. 127, ♀ (1913).

"♀. Distinguishable from typical *silvestrii*, Kieff., by its colour and size. Black. Antennæ entirely black. Wings with a more distinct brownish tinge. Legs brownish red, coxæ black. Clubs of the femora blackish brown. Length 4 mm."

French Guinea (Konakry, parasite of *Ceratitis punctata*, Wiedemann).

Galesus difficilis, sp. n.

♀. Black. Legs reddish except coxæ and femora, which are black.

Head: slightly longer than broad. Details of frons as in *silvestrii*, Kieff. Lateral margins of frons produced in the same way as in *silvestrii*, Kieff. This carina posteriorly is represented only by a complete row of punctures, and does not project strongly if the head is viewed from above. Antennæ: pedicel shorter than first joint of funicle, shining; first joint of funicle nearly twice as long as wide; second distinctly though not much longer than wide; third slightly shorter than second; fourth as long as wide; fifth nearer in size to sixth than to fourth; joints 5–9 transverse, together with the tenth forming a strongly thickened club.

Thorax: normal. Wings apically excised.

Abdomen: basal sulcus of second tergite distinct to about the middle of the segment, thence continued as a weakly impressed broken line to the apex. Second sternite apically closely punctate.

Length: 2·7 mm.

♂. Antennæ entirely black. Legs to the naked eye quite black; on examination the tarsi are seen to be dark reddish or piceous.

Head: as broad as long. Antennæ: pedicel shorter than first joint of funicle, shining; funicle somewhat roughly sculptured, clothed with short semi-erect brownish hairs; first joint twice as long as its greatest width, evenly curved beneath; second equal in length to first, usually carinate beneath to about half-way; joints 3–11 cylindrical, subequal in length, decreasing slightly in width after the seventh; basal joints one and two-thirds as long as wide, apical joints proportionately longer.

Length: 2·8 mm.

Cape Province (Mossel Bay, Transkei); Zululand (Mtunzini).

In structure remarkably like *G. silvestrii*, Kieff., and perhaps only a race of that species. The colour, however, especially the black legs of the male, render it superficially quite distinct.

Galesus muscidorum, Dodd.

Trans. Ent. Soc. Lond. p. 381, ♀ (1919).

♀. Differs from that of *silvestrii*, Kieff., most noticeably in its larger size and its length, which is 4 mm.

The legs are variable in colour, either entirely dark red, with only the coxæ black, as in the type, or with the femora sometimes infuscate as in the South African examples. Antennæ entirely black, in structural detail like those of *silvestrii*, Kieff.

Abdomen: apical two-thirds of second tergite conspicuously punctate. In South African examples the punctures tend to become larger and more numerous on the deflexed portions of the tergite.

♂ (hitherto undescribed):—

Head: distinctly transverse. Seen from above the eyes appear conspicuously prominent; the distance between the external projections of the frons about equal to half the distance across the eyes. Antennæ: scape apically nearly truncate, its lateral lamellæ hardly produced; pedicel slightly more than half as long as the first joint of funicle; funicle entirely black, clothed with short stiff hairs which in no way obscure its somewhat rough sculpture; first joint twice as long as its greatest width; second slightly shorter, widest apically; joints 3–11 cylindrical, decreasing slightly in width towards apical end of funicle, the basal joints one and two-thirds as long as wide. Eyes surrounded by a carina as in *silvestrii*, Kieff.

Abdomen: second tergite on its deflexed portions apically more densely punctured than in ♀.

Length: 3–8 mm.

Type bred from Muscid puparium in breeding-ground of *Glossina palpalis*, R. D., Uganda (*G. D. H. Carpenter*).

Cape Province (Port St. John); Natal (Kloof). 3 ♀♀, 1 ♀.

Galesus punctulatus, Kieff.

Berlin. Ent. Z. v. 51, p. 301, ♂ (1907).

♂. Black. Pedicel reddish. Legs dark red; coxæ dusky.

Head: slightly transverse, strongly narrowed behind. Antennæ: pedicel slightly more than half as long as first joint of funicle. First joint of funicle two and a half times as long as wide; second with a slight excavation on its basal fourth, otherwise cylindrical, twice as long as wide; joints 3–11 subequal in length decreasing slightly in width towards apex of funicle, twice as long as wide. Wings without an excision.

Abdomen: apical half of second tergite densely punctate and thickly clothed with long decumbent hairs.

Length: 3·5 mm.

Natal.

Galesus conradti, Kieff.

Ergeb. Zentr.-Afr. Exp. v. 3, fasc. 2, p. 8, ♀ (1910).

The following is a translation of Kieffer's description of the species:—

"♀. Black. Head somewhat oblong, smooth, rounded behind, in front with three teeth. Vertex with two punctures, which are separated from the ocelli and the occipital margin by an equal distance; a row of punctures surrounds the eyes, another borders the occipital margin. Frons with three impressions; antennal prominence emarginate. Scape straight, apically gradually thickened, with two sharp teeth on the medial edge of its apex, which is laterally obliquely truncated, joint 2 but little longer than 3, 3–8 somewhat oblong, then nearly moniliform, 9–12 gradually thickened, 12 twice as long as the preceding joint. Mesonotum somewhat flattened. Parapsidal furrows not widened posteriorly. Scutellum with six hollows, the two anterior ones oval and oblique. Wings extending beyond the abdomen, hyaline, with an excision. Legs red, coxæ and clubs of the femora and tibiæ black. Petiole somewhat longer than broad, with longitudinal striæ; sulcus of the second tergite extending beyond the basal third of the abdomen. Length 3 mm."

Cameroon.

XLV.—*New Species of Microlepidoptera in the Collection of the British Museum.* By HERBERT STRINGER.

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THE following species have for many years been represented in the Museum Collection, some of the specimens with names proposed by the late Lord Walsingham, and so far as I can ascertain not yet described. As it is probable that other collections may contain specimens presented by Lord Walsingham bearing these manuscript names, I propose to adopt them.

The species are all Japanese, and the British Museum is much indebted to Prof. S. Issiki for his kindness in adding paratypes and other good specimens, provided with definite data, to the material already in its possession.

TINEINA.

Gelechiadæ.

Dichomeris tostella, sp. n.

♂.—22 mm. *Antennæ* pale ochreous, with distinct fuscous annulations. *Palpi*, second segment with a strong projecting triangular tuft; olivaceous brownish ochreous, a smoky shade at the base; third segment ochreous, a fuscous line along the underside. *Head* and *thorax* olivaceous brownish ochreous. *Abdomen* greyish fuscous. *Legs* brownish ochreous, shaded externally with greyish fuscous, tarsal joints with pale annulations. *Fore wings* narrow, dilated posteriorly, apex pointed, termen oblique; olivaceous brownish ochreous, slightly sprinkled with fuscous, especially along the costa and across the outer half of the cell, a shade of the same forming a patch at the base of the costa; cilia of the same colour as the wing. *Hind wings* and cilia greyish fuscous, the latter slightly paler.

Holotype, ♂ (70764), JAPAN, 1886 (*Pryer*). *Paratypes*, Kiusiu, Nagasaki, vi. 1886 (*Leech*); Honsiu, Oyama, 18. v. 1895 (*Wileman*); Nikko, 2000 ft. 28. v. 1895 (*Wileman*). 4 ex.

Differs from *ustulella*, Fab., in the absence of the dark terminal shade and in the rather paler or more ochreous wing-colour being continued evenly through the cilia; the wings are also somewhat broader, the hind wings being paler and the cilia not strongly contrasted by their paler colouring as in that species.

Cosmopterygidæ.

Cosmopteryx fulminella, sp. n.

♂.—9 mm. *Antennæ* brown, some faint greyish annulations. *Palpi* and *head* bronzy brownish. *Thorax* bronzy brown, with two fine silvery lines. *Abdomen* brownish. *Legs* bronzy brownish, with white annulations at the joints; hind tarsi white. *Fore wings* bronzy black, with three fine silvery lines before band, each obliquely beyond the one above it; there is also a fine line on the dorsum; a rich orange-yellow postmedian band, twice as wide on costa as on dorsum, margined anteriorly by a bright lilac iridescent silvery streak, a black dot at its outer edge, above the middle, and posteriorly by two lilac iridescent silvery spots, the costal spot being smaller and accompanied by some white scales in the cilia; between these spots the orange-yellow band projects, continuing as a partially interrupted metallic line to the apical cilia; cilia, with the above exception, smoky brownish black. *Hind wings* and cilia smoky brownish.

Holotype, ♂, JAPAN, 1886 (*Pryer*). *Paratypes*, 2 ♂ ♂, 1886 (*Pryer*). 3 ex. [*Paratypes* Honsiu, Kii, Hasimoto, 24. v., 16. vi., 9. ix. 1920 (*Issiki*). Issiki Coll. 4 ex.]

Cosmopteryx victor, sp. n.

♂.—13 mm. *Antennæ* buff-brown above, lined white. *Palpi* white, a slender buff-brown line along their upper sides throughout. *Head* and *thorax* buff-brown, with three fine white lines. *Abdomen* brown. *Legs* brown, hind spurs and tarsi white. *Fore wings* buff-brown, with three white lines, one commencing at the base of the costa and thence slightly depressed, a second beginning near the base and extending beyond the end of the first, with a shorter one lying parallel below its outer half; there is also a slender line along costa reaching the band, and one at base of dorsum; a broad bright ochre-yellow postmedian band, broader on costa than dorsum, margined anteriorly by pale golden metallic scales, a black dot at their outer edge above the middle, and posteriorly by two pale golden metallic spots; between these the ochre-yellow band is slightly projected, the dorsal spot is large and quadrangular, throwing out a slender white line to the apex from its upper angle, the costal spot is small, and fringed with white scales above; cilia buff-brown. *Hind wings* and cilia greyish brown.

Holotype, ♂, JAPAN, Tokyo, Inokasira, vii. 1920 (*S. Issiki*). *Paratypes*, Japan, 1886 (*Pryer*). 3 ex.

Œcophoridæ.

Depressaria acuta, sp. n.

♂ ♀.—20–24 mm. *Antennæ* fawn-ochreous. *Palpi* pale fawn-ochreous, second segment sprinkled and third segment biannulate fawn-brown. *Head* and *thorax* fawn-ochreous, suffused fuscous along centre. *Abdomen* greyish brown, a triangular dark brownish patch at the base, anal tuft pale fawn-ochreous. *Legs* whitish ochreous. *Fore wings*, costa gently arched, apex acutely angular, termen oblique, rounded; 2 and 3 stalked; pale fawn-ochreous, sparsely sprinkled with darker fawn-brown scales, shaded fawn-brown along fold on either side and along termen to apex; first stigma small, fawn-brown, plical similar, slightly obliquely beneath it, second discal conspicuous, round, fawn-brown centred with whitish; a terminal series of four or five fawn-brown spots; cilia pale fawn-brown, towards tornus fawn-ochreous; ♀, *fore wings* and cilia pale ochreous, a chestnut suffusion at base of dorsum and around tornus. *Hind wings* shining pale grey-brown; cilia whitish cinereous, a brown shade along their base.

Holotype, ♂, JAPAN, Honsiu, Oiwake, x. 1886 (*Leech*). *Allotype*, ♀, Japan, 1886 (*Pryer*). *Paratypes*, 1886 (*Pryer*). 11 ex.

Depressaria roseocaudella, sp. n.

♂.—24 mm. *Antennæ* fuscous. *Palpi* light ochreous, second segment with divided roughened scale clothing beneath, shaded externally with fuscous. *Face* and *head* light ochreous. *Thorax* light ochreous, some fuscous scales at sides of raised posterior tuft. *Abdomen* greyish ochreous, anal tuft and underside bright rosy. *Legs* ochreous, femora and tarsi with a fuscous shade externally, tibiæ bright rosy. *Fore wings* moderate, costa gently arched, termen oblique, rounded; 2 and 3 stalked; light ochreous, dusted and spotted violet-black; a diffused fawn-brown streak, mixed with violet-black at its origin and towards its apical extremity, from near base of dorsum curving across fold to tornus and thence upward to apex; a large reduplicated blackish spot with scattered black scales at two-thirds, a suffusion of fawn-brown mingled with this and produced shortly outward; this group is preceded by a pair of obliquely placed blackish dots; a terminal series of four spots; cilia at apex fuscous to chestnut-brown, towards tornus light ochreous; underside pale rosy grey, costal and terminal margins bright rosy, apex tipped black. *Hind wings* pale rosy grey; cilia tinged rosy, paler on dorsum; underside rosy grey, becoming bright rosy posteriorly, apical area freely reticulated with black scales.

Holotype, ♂ (70606), JAPAN, 1886 (*Pryer*). *Paratypes*, Hokkaido (=Yesso Id.), 1882 (*Pryer*); Honsiu, Yoshino, 984 ft., vi.–vii. 1899 (*Wileman*). 5 ex. [Hokkaido, Mt. Teine, ix. 1918 (*Issiki*). Issiki Coll. 1 ex.]

Depressaria pallidior, sp. n.

♂.—27 mm. *Antennæ* pale ochreous, becoming darker outwardly. *Palpi* pale ochreous, second segment thickly clothed beneath, some fuscous scales externally, third segment with basal and median bands of fawn-brown. *Thorax* pale ochreous, shaded and spotted fawn-brown. *Abdomen* greyish brown, anal tuft paler; underside with distinct segmental fawn-brown spots. *Legs* pale ochreous, spurs and tarsi irrorated fawn-brown. *Fore wings* slightly dilated, apex acute, tornus rounded; 2 and 3 stalked; pale ochreous, irregularly and minutely sprinkled fawn-brown, particularly along the costal half, a triangular fuscous spot at base of costa, first discal stigma blackish, an additional dot obliquely before and above it, second discal indicated by a blackish suffusion, a ferruginous dash followed by a dot of the same colour immediately below this suffusion; a terminal series of fawn-brown spots; cilia pale ochreous, darker towards tornus; underside, costa irregularly spotted throughout with dark brown scales, a reduplicated dark brown spot at apex. *Hind wings* shining ochreous grey; cilia paler, a basal fuscous line; underside, apical area with scattered brown scales.

Holotype, ♂, JAPAN, Hokkaido, Hakodate, viii. 1886 (*Leech*). *Paratypes*, Hokkaido, Oshima, Junsai Numa, 7. v. 1902 (*Wileman*); Shikoku, Iyo, Shoki, 28. v. 1896 (*Wileman*). 4 ex.

Glyphipterygidæ.

Lamprystica igneola, sp. n.

♂ ♀.—16–23 mm. *Antennæ* purple to beyond basal half, thence silvery white to apex. *Palpi* golden-yellow, third segment somewhat darker. *Head* shining bronzy with purple reflections. *Thorax* smooth, shining purple. *Abdomen* fuscous grey, anal tuft with some purple scales; underside pale ochreous, segmental margins fuscous. *Legs*, posterior tibiæ slightly loose-haired above first pair of spurs; purple, joints and spurs pale ochreous. *Fore wings* elongate, evenly lanceolate, costa almost straight, apex depressed; shining golden-bronze; costa purple-bronze; a rich shining deep purple patch includes apex and termen, immediately preceded by a reduplicated rich shining golden-yellow spot at end of cell; cilia dark bronzy grey. *Hind wings* dark bronzy brown; cilia dark bronzy grey.

Holotype, ♂ (70626); *allotype*, ♀ (70623), JAPAN, 1886 (*Pryer*). *Paratypes*, Hokkaido, Ishikari, Tobetsu, 2. viii. 1902 (*Wileman*); Shikoku, Iyo, Osuki, 28. vi. 1896 (*Wileman*); Honsiu, Yamato, Kashiwagi, 15. vii. 1894 (*Wileman*); CHINA, Ichang, Chang Yang, 1886 (*Pratt*). 20 ex. [Honshu, Kii, Mt. Iwawakisan, vi.–viii. 1920 (*Issiki*). Issiki Coll.]

Hilarographa mikadonis, sp. n.

♂.—18 mm. *Antennæ* strongly biciliate in ♂; ochraceous brownish. *Palpi* short, upturned, smooth; white; second segment shaded on its lower half with ochreous. *Head* greyish ochraceous. *Thorax* brownish; tegulæ greyish ochraceous. *Abdomen* brown. *Legs* dirty white, spotted with brown on the ends of the tibiæ and on tarsi. *Fore wings* elongate, triangular, termen sinuate beneath apex, rounded; brownish, varying to brownish fuscous, much streaked and mottled with varying shades of colour; on the greyish-ochreous base are three yellowish longitudinal streaks, the first along costa, its apex deflected downward at one-fourth from the base, meeting the apex of the second, which is straight, the third shorter, bent upward across the fold, also toward the apex of the second; some yellowish hair-scales at the base of the dorsum, indicating a fourth pale streak; beyond these streaks, where the ground-colour is darker, are two short, outwardly oblique, pale ochraceous costal streaks on either side of the middle, followed by a third which blends in the mottled pattern of the apical area; on the dorsum before the middle is a series of three outwardly oblique, slightly curved, whitish parallel streaks rising to the cell, the first rather wider than the others, the third sometimes looped at its base; halfway between these and a similar series of shorter and more sinuate streaks are three detached ochreous spots, one on the dorsum, another on vein 2, and a third at the end of the cell, beyond which the dark ground is mottled or spotted with ochreous and white in an ill-defined patch, bounded outwardly by a curved yellow-ochreous band, of which the upper half is broader than the lower and separated by a narrow, oblique, shining steel-grey line from an equally conspicuous patch of the same colour before the apex; the steel-grey line is silvery white at its origin on the costa, and blends outward with a silvery white streak, inwardly dark-margined, which reverts to the costa, thus enclosing the ochreous patch; the upper portion of the space in which these markings lie is tinged with rich rust-brown, and this is continued toward the termen and to the apex beyond the silver streak, a smaller inverted silver streak interrupting it at the subapical indentation of the termen; a series of four black spots, set in a narrow strip of pale ochreous, runs parallel to the lower half of the termen; costal and apical cilia touched with silvery white, terminal cilia brownish fuscous. *Hind wings* brown; the outer two-thirds of cilia whitish.

Holotype, ♂, JAPAN, Sapporo, vii. 1917 (*Issiki*). *Paratype*, ♂, Hokkaido, 1882 (*Pryer*). 2 ex.

Hyponomeutidæ.

Hyponomeuta anatolica, sp. n.

♀.—22 mm. *Antennæ* leaden grey, basal segment white. *Palpi* grey, paler on their inner sides. *Head* white, two obscure dark spots posteriorly. *Thorax* leaden grey, with two pairs of black spots, the anterior pair closely approximate; tegulæ with one black spot at their base. *Abdomen* greyish fuscous, with a pale leaden grey bar across the base. *Legs* leaden grey. *Fore wings*, costa gently arched, apex obtuse, termen slightly oblique; pale leaden grey, a slightly darker shade around the margins; a confused scattering of small black spots below the costa, from base nearly to apex, and two rather distinct lines of the same, varying from nine to eleven in each line, one above the fold, the other below it, each reaching to four-fifths from the base, the middle spots more approximate to each other than those toward the ends of the lines; cilia concolorous with the wing. *Hind wings* greyish fuscous; cilia rather paler brownish grey; a conspicuous fenestrum below the base of the cell.

Holotype, ♀ (62307), Japan, Honsiu, Fushiki, vii. 1886 (*Leech*). *Paratype*, Kii, Mt. Iwawakisan, vi.1920 (*Issiki*). 2 ex.
[*Paratype*, Honsiu, Nara, viii. 1919 (*Issiki*). Issiki Coll.]

This may be compared with *fumigatus* Zell. (S. Africa), which, however, has fewer spots and more elongate fore wings.

Plutellidæ.

Niphonympha anas, sp. n.

♂.—13–15 mm. *Antennæ*, *palpi*, *head*, and *thorax* white. *Abdomen* grey; anal tuft white. *Legs* white, tarsi and spurs grey. *Fore wings*, costa gently arched, apex obtuse, termen oblique, rounded; an oval subhyaline patch between vein 12 and cell; shining white, sparsely sprinkled with fuscous scales along costal half to apex, some fuscous scales indicating an outwardly oblique streak on fold about the middle of, but not reaching, dorsum; cilia white, outer third fuscous. *Hind wings* light grey; cilia silvery white.

Holotype, ♂ (70654), Japan, 1886 (*Pryer*). *Paratypes*, Honsiu, Yamato, Yoshino, vi. 1900 (*Wileman*); Kiusiu, Nagasaki, vi. 1886 (*Leech*). 13 ex.

Similar to *N. argophanes*, Meyr., from which it differs in the fuscous scaling, the almost total absence of the mid-dorsal streak, the fuscous mark before tornus, and the paler hind wings.

Lyonetiadæ.

Opogona nipponica, sp. n.

♀.—12 mm. *Antennæ* and *palpi* pale yellow. *Head* pale yellow, a brownish shade posteriorly. *Thorax* pale yellow. *Abdomen* and *legs* brownish cinereous. *Fore wings* pale yellow nearly to their middle, this pale space clearly and straightly defined against the outer portion of the wing, which is dark purplish grey; cilia fading to brownish grey. *Hind wings* shining pale brownish grey; cilia pale brownish.

Holotype, ♀ (70695), Japan, Honsiu, Oiwake, 1885 (*Pryer*). *Paratypes*, Oiwake (*Pryer*). 4 ex.

This species differs from *O. dimidiatella* Zell., to which it is allied, by the upright line of division between the two colours of the fore wing and by the absence of an elongate triangular brownish spot at the base of the costa.

Adelidæ.

Nemophora japonica, sp. n.

♂.—18–19 mm. *Antennæ* purple on basal half, white beyond. *Palpi* ochreous, third segment fuscous. *Head* orange-ochreous; face purple; eyes not enlarged. *Thorax* shining brassy metallic;

tegulæ purple at their base. *Abdomen* dark fuscous. *Legs* stramineous, with fuscous tarsal annulations. *Fore wings* elongate, dilated posteriorly, termen very oblique; brownish ochreous, with two narrow, shining, steel-blue fasciæ, one about, the other beyond, the middle; the first straight, narrowly dark margined on its inner side; on the base of the wing, two slender black longitudinal lines and four steel-blue narrowly black-margined metallic streaks, not reaching to the first fascia; the first along costa, lilac at its base, the second below it, shorter, arising obliquely from the middle of the first black line, the third below this, arising from the base of the same line; a second black line equidistant between this and the fourth, which is below the fold; on the apical fourth, separated from the outer fascia by a space of the ochreous ground-colour, a brilliant lilac-metallic patch overspreads the end of the wing, its upper third shaded with black which runs narrowly along its unevenly serrated anterior margin; cilia cupreous; underside, apical area rich purple, preceded by a golden fascia. *Hind wings* purplish fuscous, the basal two-thirds of the costa stramineous; cilia fuscous, a golden sheen at their base; underside, apical area rich purple.

Holotype, ♂, Japan, Kii, Mt. Iwawakisan, v. 1920 (*Issiki*). *Paratypes*, Japan, 1886 (*Pryer*); Kiusiu, Gokanosyo, vi. 1926 (*Issiki*). 3 ex.

Nemophora trimetrella, sp. n.

♀.—16 mm. *Antennæ* scarcely thickened on the basal half; bronzy brown; underside of basal segment yellowish; the outer half white. *Palpi* yellow. *Head* yellow above; *face* bronzy. *Thorax* bronzy brown. *Abdomen* fuscous with a bronzy sheen. *Hind legs* pale ochreous touched with bronzy brown. *Fore wings* elongate, termen very obliquely rounded; 8 and 9 stalked; pale bronzy brown, with three pale yellow fasciaform transverse bands, the first, bending outwards from costa near the base, reverts to the fold, beneath which it is dilated downwards and turned back in a short point to the wing-base, but does not reach the dorsum; a second, narrow and almost straight, from costa to dorsum at about one-third; a third about the middle, its inner edge straight, the outer side expanded towards costa and dorsum, giving the appearance of two wedge-shaped spots narrowly joined at their apices in the middle of the cell; all these bands are very narrowly margined on both sides by brown scales, slightly darker than the intermediate pale brown spaces, each of which contains a central line of shining lilac; beyond the outer fascia are six pale yellow longitudinal streaks, two on the costal and four on the dorsal half, a lilac streak separating the two groups and running to the purplish apex; cilia shining bronzy. *Hind wings* purple, with a bronzy sheen at the base of the greyish cilia.

Holotype, ♀, Japan, 1886 (*Pryer*). *Paratype*, ♀, Yokohama (*Jonas*), Brit. Mus. 1877–9. 2 ex.

Nemophora ahenea, sp. n.

♂.—12 mm. *Antennæ* cinereous, speckled and shaded with cupreous towards base; basal segment metallic golden cupreous. *Palpi* ochreous. *Head* and *face* ochreous; *eyes* very large, nearly approximated on crown. *Thorax* metallic golden-green. *Abdomen* fuscous. *Legs* pale fuscous, the spurs and joints of the tarsi black. *Fore wings* posteriorly dilated, termen very obliquely rounded; brilliant metallic golden cupreous, more golden on the basal half, with some golden-green below the fold; two glossy black transverse bands, the first at the base scarcely reaching to the dorsum, with some brilliant blue scales near the thorax; the second in the middle, narrowed to the dorsum and bordered on its inner edge by a narrow bright blue line; cilia golden cupreous. *Hind wings* and cilia fuscous, with an æneous reflection.

Holotype, ♂, JAPAN, Honsiu, Kii, Mt. Iwawakisan, vii. 1920 (*Issiki*). *Paratypes*, Mt. Iwawakisan, 19. viii. 1920 (*Issiki*); Japan, 1886 (*Pryer*). 3 ex.

Nemophora umbripennis, sp. n.

♂.—15 mm. *Antennæ* cinereous, blackish towards the base. *Palpi* thickly clothed with long hairs; black. *Head* black; eyes not meeting above in the ♂. *Thorax* metallic steel-blue. *Abdomen* dark umber-brown. *Hind legs* brown, clothed with greyish hairs; tarsi with three white annulations. *Fore wings* moderate, termen very oblique, rounded; dark umber-brown, a narrow, pale, straw-yellow central fascia, dilated on dorsum, and lying between two steel-blue bands of equal width, from which it is separated on either side by a black line of about half its width; the first of these is continued to the base narrowly along the costa, the second along the base of the cilia and around apex as far as the commencement of the costal cilia; cilia tipped with cupreous. *Hind wings* brownish cupreous; cilia with a darker line along their base.

Holotype, ♂, JAPAN, 1886 (*Pryer*). 1 ex.

XLVI.—*New Japanese and Formosan Microlepidoptera*. By SYÛTI T. ISSIKI, Professor of Entomology, College of Agriculture, Taihoku, Japan.

THE following descriptions are drawn from specimens in my collection, the specific names being required for immediate use in other works. The determination of the species was made in the British Museum (N.H.), through comparison with specimens in the Walsingham Collections and with descriptions of various authors. Many of the paratypes of each species will be presented to the Museum.

I am very grateful to the Keeper of Entomology (Major E. E. Austen, D.S.O.) for allowing me the use of the wonderful collections of Tineina, and especially to Mr. H. Stringer, not only for his kind assistance in examining the specimens and his aid with the bibliographical works, but also the orthographical corrections of the following descriptions.

TINEINA.

Glyphipterygidæ.

Tortyra angustistriata, sp. n.

♂ ♀.—14–15 mm. *Antennæ* thick; black, irrorated with blue and purple golden, apex brownish black, with a broad subapical white band. *Palpi* brownish black, leaden-metallic in some lights; basal segment and ventral side of second segment white. *Head* dark bluish bronzy. *Thorax* and *tegulæ* dark bronzy fuscous, with three longitudinal metallic-green streaks. *Abdomen* dark fuscous, segmental margins leaden-metallic in some lights. *Legs*, hind tibiæ with sparse long hairs above, dark bronzy fuscous, apex white; tarsi fuscous bronze, second and third segments ringed with white. *Fore wings* not broad, little dilated posteriorly, costa nearly straight, slightly arched before apex, termen slightly rounded, little oblique; dark olive-brown on the basal half; three straight divergent metallic-green streaks from base to a little beyond one-third, one immediately below the costa, one just above the fold, one above dorsum, a little longer; a transverse metallic-green curved streak from costa just before middle to fold; a similar streak from middle of dorsum to fold, terminating immediately before the end of the costal streak; a broad black fascia from costa beyond middle to two-thirds of the dorsum, followed by an irregular band of suffused purple-golden, the inner margin of the band blue-metallic in some lights; the area beyond this dark fuscous bronze, somewhat suffused with olive, metallic-purple in some lights; an irregular band of suffused purple-golden immediately before the termen from below apex to above tornus; cilia dark bronzy fuscous, leaden-metallic in some lights, a dark basal line. *Hind wings* dark fuscous; cilia grey, paler about apex, a dark basal line.

Hab. FORMOSA: 3 ♀ ♀, 1 ♂ (type ♀). Tipon near Taitô, 4. vii. 1927 (*author*); also one specimen in British Museum (Wileman Coll.).

Allied to *T. elegans*, Wlsm., but distinguished from it by the absence of the semitransparent basal area of the hind wings; other allies *æolodoxa*, Meyr., and *cyprida*, Meyr.

Simæthis nigromaculata, sp. n.

♀.—15 mm. *Antennæ* ochreous yellow. *Palpi* curved, ascending, second segment long, thickened, rough beneath, third segment shorter, pointed; greyish yellow. *Head* ochreous yellow. *Thorax* bronzy fuscous, irrorated with reddish ochreous laterally, a leaden-metallic median longitudinal line; tegulæ bronzy fuscous, reddish ochreous medially, inner margins streaked with blue leaden-metallic. *Abdomen* reddish ochreous, irrorated with dark fuscous. *Legs*, hind tibiæ dark fuscous, internally greyish yellow, with conspicuous terminal spines above; tarsi greyish yellow, marked with dark fuscous above. *Fore wings* broad basally, slightly dilated posteriorly, costa gently arched, termen very slightly sinuate, not oblique, lower angle of basal cell not produced, Cu_{1b} from two-thirds of the cell, R_4 and R_5 separate, R_3 from a little before angle, R_2 from beyond middle, R_1 from before middle, without secondary cell; fuscous brown on median and dorsal areas irrorated with grey, a large black blotch on dorsum before tornus; basal, costal, and apical areas reddish ochreous; costal area irregularly and minutely spotted with black; two short blue-metallic basal streaks, one below the costa, the other just above the fold, shorter; an outwardly oblique short blue-metallic streak from dorsum near base to fold; a strongly outcurved transverse blue-metallic streak immediately below costa, a little beyond tip of the anterior basal streak, scarcely reaching half across wing; an elongate blue-metallic spot in disc; a curved blue metallic streak from immediately below costa just beyond middle to above tornus, suffusedly margined with dark fuscous; a similar but less curved streak from below costa at four-fifths, towards middle of termen, but scarcely reaching it; a spot of the same colour below costa between these two streaks; a blue-metallic, subapical, elongate spot below costa; a small leaden-metallic dot at the apex; the dorsal black blotch contains several minute reddish ochreous spots, two minute white spots and three leaden-metallic spots on outer margin; the area before this blotch is very obscurely and suffusedly streaked transversely with grey; cilia dark bronzy fuscous, reddish ochreous at the base mixed with black scales. *Hind wings* fuscous brown, median and terminal areas reddish ochreous; a large irregular black blotch on the middle of the termen containing a blue-metallic subterminal streak; tornal area dotted with reddish ochreous and grey; cilia fuscous brown, a dark basal line, mixed with reddish scales.

Hab. JAPAN: 3 ♀♀ (type ♀), Mt. Iwawakisan, Osakafu, 9. viii. 1918 (*author*); 1 ♀, 8. viii. 1919 (*author*).

The venation of the fore wings differs somewhat from typical species of the genus: the position of vein R_2 and R_3 may be of generic value.

Brenthia japonica, sp. n.

♂ ♀.—8–10 mm. *Antennæ* dark fuscous above, white below. *Palpi* white, second and third segments each with dark fuscous basal and subapical bands. *Head, thorax*, and *abdomen* dark fuscous. *Legs*, posterior tibiæ dark fuscous, with a broad median white band, tarsi white, with a ring and apical parts dark fuscous. *Fore wings* elongate-triangular, costa slightly arched, apex rounded, termen almost straight, little oblique; dark fuscous; a suffused white transverse streak from dorsum to costa about one-fourth; an irregular transverse fascia of whitish suffusion about middle, and a short obscure transverse fascia of whitish irroration about three-fourths, not extending to dorsum; between these two fasciæ a transverse elongate white spot on disc; black terminal fascia divided into three large blotches by whitish fuscous bars, the apical and median blotches round, each with three brilliant violet-blue metallic terminal dots, besides a spot of the same colour on the anterior margin of the apical one, the tornal blotch is long, narrow, and suffused anteriorly, with one metallic terminal dot; these three blotches are margined anteriorly grey; cilia fuscous, a broad dark fuscous antemedian line. *Hind wings* dark fuscous; an oblique-oval whitish mark in disc before middle; an ill-defined subterminal line parallel to termen, clear white about middle, terminating in a purple-metallic spot on costa, a short violet-metallic terminal streak at apex; cilia fuscous; a darker basal line, interrupted at middle of termen with a suffused white patch.

Hab. JAPAN: 16 ex., Hasimoto, Wakayamaken, ix. 1920 (*author*).

Brenthia formosensis, sp. n.

♂ ♀.—9–10 mm. *Palpi* white, second and third segments with dark fuscous basal and subapical rings. *Head, thorax*, and *abdomen* dark fuscous. *Legs*, posterior tibiæ dark fuscous, with a broad white median ring; tarsi white, apex of three basal segments and all of the two apical segments dark fuscous. *Fore wings* elongate-triangular, costa gently arched, apex rounded-obtuse, termen somewhat rounded, little oblique; dark fuscous; a nearly straight transverse streak of white suffusion about one-fourth, slightly inwards oblique from costa; a median transverse band of white irroration, widely interrupted in the middle; a narrow subterminal transverse band of whitish irroration; nearly parallel to the termen, the space between these irregularly marbled with whitish irroration except on costa and dorsum, a transverse oval spot in disc outlined suffused white; the black terminal fascia consists of eight elongate spots, margined with fuscous, each containing a blue-metallic subapical dot, the fourth and fifth spots are united into a quadrate blotch; cilia fuscous, with a dark basal line. *Hind wings* dark fuscous, an irregular white mark in disc before middle, an ill-defined subterminal line parallel to termen, becoming white on costa and for a short distance towards middle; a rather broad purplish-metallic short streak at apex; cilia dark fuscous, with a darker basal shade, tipped with white at apex and a white median line in middle of termen.

Hab. FORMOSA, 7 ex., Taihoku, x. 1923 (*author*); 2 ex., Urai, near Taihoku, v. 1925 (*author*).

Glyphipteryx nigromarginata, sp. n.

♂ ♀.—11–12 mm. *Antennæ* greyish fuscous, irrorated with whitish. *Palpi* somewhat rough beneath; grey, with four greyish fuscous rings. *Head* and *thorax* greyish fuscous. *Abdomen* greyish fuscous, segmental margins partially whitish. *Legs*, hind tibiæ greyish fuscous with a whitish median ring, apex white, spurs paler; tarsi greyish fuscous, first to fourth segments with white tips. *Fore wings* moderate, only a little dilated posteriorly, costa slightly arched; apex obtuse, termen gently rounded, oblique; R_4 and R_5 separate; bronzy yellow, base greyish fuscous; a short white fascia from dorsum at one-fourth, outwardly oblique, extending a little beyond the fold; a leaden-metallic short transverse streak from costa at one-fourth, a little outwardly oblique, scarcely reaching fold; two nearly parallel, straight, entire, transverse leaden-metallic streaks from before and beyond middle of costa to dorsum beyond middle and before tornus, white on costa and dorsum, a transverse streak of leaden-metallic from white costal spot at three-fourths, extending to above tornus; two elongate leaden-metallic spots, white on costa near apex; a black terminal fascia from apex to tornus contains seven marginal spots, the second yellowish, others all blue-metallic; in the area between this fascia and the preceding streak are some suffused black longitudinal lines; cilia greyish fuscous, glossy, outer half whitish. *Hind wings* light greyish fuscous; cilia greyish fuscous.

Hab. JAPAN: 6 ex., Hasimoto, Wakayamaken, iv.1920 (*author*), containing type; 1 ex., Kyôto, 26.iv.1915 (*Prof. I. Sugitani*); 1 ex., Ikeno, Gifuken, 8.v.1916 (*K. Takeuchi*); 1 ex., Kamikôti, 5000 ft., Naganoken, 17.vii.1922 (*author*); 1 ex., Zyôzankei, Hokkaido, 22.vi.1919 (*author*); also 3 ex., British Museum (*Pryer*, 1886).

Glyphipteryx semiflavana, sp. n.

♂ ♀.—12–14 mm. *Antennæ* greyish fuscous. *Palpi* white, with four ventrally convergent whorls of black, tipped with white scales, third segment with a black streak on ventral edge. *Head* and *thorax* greyish fuscous. *Abdomen* greyish fuscous, segmental margins paler. *Legs*, hind tibiæ greyish fuscous, white on middle; tarsi greyish fuscous, apex of first three segments and last two entire segments white. *Fore wings* rather narrow at the base, posteriorly strongly dilated, costa gently arched, apex obtuse-pointed, termen oblique, sinuate below apex; R_4 and R_5 separate; basal area greyish fuscous, posterior three-fifths bronzy yellow; a thick oblique curved white streak from dorsum before middle, attenuated gradually throughout to tip, reaching beyond half across the wing, and terminating in a leaden-metallic spot; six white short streaks from costa, indistinctly darker margined anteriorly, first two oblique, others gradually less so, first from a little before middle; second, the longest, beyond middle, scarcely reaching half across wing, and terminating with a leaden-metallic line a little beyond the apex of the dorsal streak; third short, with a leaden-metallic tip; outer three very short, wedge-shaped, often with leaden-metallic tips; last two close together just before apex; a rather short erect leaden-metallic streak from dorsum before tornus, white on margin; two round spots of leaden-metallic beyond the disc in a curved series with the tornal streak; a short leaden-metallic streak on termen above tornus; the area above this more or less suffused with black; a small leaden-metallic spot on termen beneath apex, adjoining a semicircular black apical spot; cilia shining fuscous grey at base, with a suffused darker grey line, outer half whitish, indented with white beneath apex, and above apex with a dark fuscous hook. *Hind wings* rather dark fuscous; cilia grey.

Hab. JAPAN; 5 ex., Hasimoto, Wakayamaken, v. 1920 (*author*).

Glyphipteryx basifasciata, sp. n.

♂ ♀.—13–15 mm. *Antennæ* greyish fuscous, underside whitish. *Palpi* white, with four whorls of fuscous tipped with white scales, apex somewhat fuscous. *Head* and *thorax* greyish fuscous. *Abdomen* greyish fuscous, segmental margins partially whitish. *Fore wings* broad, costa very slightly arched, dorsum rounded on basal two-thirds, apex obtuse, termen sinuate-indented beneath apex, strongly oblique; R_4 and R_5 separate; greyish yellow; an acute triangular white blotch on dorsum before middle, reaching to or nearly to costa; entire space before, and posterior margin of this blotch, greyish fuscous; an entire transverse streak of leaden-metallic, margined with greyish fuscous from white costal dot before middle to a little beyond middle of dorsum, nearly straight; a similar streak from a little beyond middle of costa, a little inward oblique, reaching nearly half across wing; in some specimens a white costal spot a little beyond this; an irregular but somewhat triangular large black blotch along termen from indentation to tornus, restricted basally by an elongate leaden-metallic dot on tornus, and a dot of a similar colour above it, containing seven purplish-metallic dots, four on termen, and some yellowish irregular dots basally; area above this blotch greyish fuscous, suffusedly streaked longitudinally with whitish; a blue-metallic line from a white dot on costa at four-fifths to subapical indentation; a white elongate transverse spot almost at apex from costa; cilia greyish fuscous, with a blackish median line, indented with white beneath apex, outer half whitish. *Hind wings* greyish fuscous; cilia greyish fuscous, somewhat glossy.

Hab. JAPAN: 7 ex., Sapporo, vi. 1918 & vi. 1919 (*author*).

Plutellidæ.

Eidophasia albifasciata, sp. n.

♂.—14 mm. *Antennæ* dark fuscous, some segments ringed with white. *Palpi*, second segment with scale projection dark fuscous laterally, pale greyish internally; third segment pale greyish brown, fuscous at the base laterally. *Head* ferruginous on crown; face paler. *Thorax* dark fuscous. *Abdomen* greyish fuscous. *Legs*, hind tibiæ and tarsi greyish-fuscous, each of the latter segments tipped with white. *Fore wings* elongate, only a little dilated posteriorly, apex obtuse, termen oblique; dark fuscous, a nearly straight creamy white fascia from costa at one-third to middle of dorsum, where it is dilated; a large elongate creamy white transverse dot on costa at two-thirds; in some specimens a small suffused white mark on tornus; cilia fuscous, with dark median and apical lines. *Hind wings* and cilia grey.

Hab. JAPAN: 4 ex., Tomakomai, Hokkaido, 26.vi.1919 (*author*).

Nearest to the European *messingiella*, F. v. R., but distinguished from it by the broader fascia and larger costal spot, as well as their position, *i. e.*, widely remote.

Cerostoma albistriata, sp. n,

♂ ♀.—24–26 mm. *Antennæ* pale fuscous, ringed with whitish except the basal portion. *Palpi*, tuft very long, greyish brown, suffused with whitish, whitish internally. *Head* and *thorax* pale fuscous. *Abdomen* and *hind legs* greyish fuscous. *Fore wings* elongate, costa gently arched, apex acutely produced, termen slightly bowed, strongly oblique; R_4 and R_5 long stalked: castaneous brown; dorsal and terminal area purplish, sprinkled with dark fuscous scales; two dark fuscous minute spots, one near the dorsum at one-fifth, the other just below the fold at one-half; a broad lanceolate silvery white longitudinal streak from base, covering base of costa, running along the basal cell to end of disc, distinctly defined, lower margin straight and turned upward at its apex, upper margin gently arched, the area above this narrowly suffused with dark fuscous; some suffused longitudinal grey lines along veins of apical area; a whitish suffusion from costa just before apex towards end of white streak; cilia castaneous brown, dark fuscous at the apex, becoming greyish purple at tornus. *Hind wings* greyish fuscous, veins somewhat darker; cilia grey, a broad greyish-fuscous basal shade.

Hab. JAPAN: 2 ex., Mt. Bantaisan, Fukusimaken, 5.viii. 1927 (*author*), containing type; 1 ex., Yumoto, Totigiken, 30.vii. 1922 (*author*); 1 ex., Sapporo, 23. viii. 1917 (*author*); 1 ex., Mt. Teinesan, near Sapporo, 17.ix. 1918 (*author*).

Nearest to *strigosa*, Btlr., but easily distinguished by the sharply defined white streak, terminating in a pointed apex at end of disc, and the absence of the black spot at the end of disc.

Cerostoma flava, sp. n.

♂.—15–17 mm. *Antennæ* white ringed with dark fuscous. *Palpi* with very long tuft; orange-yellow, upper margin white, third segment white. *Head* white, mixed with yellowish on crown.

Thorax white, with two longitudinal yellow streaks; *tegulæ* orange-yellow. *Abdomen* shining grey. *Legs*, posterior tibiæ white, tarsi irrorated with buff. *Fore wings* broad, costa gently arched, apex falcate, termen bowed, strongly oblique; R_4 and R_5 long stalked, Cu_{1b} from very close to angle; creamy yellow, suffusedly striated with white; a well-defined white streak on costa from base (or near base) to middle or a little beyond, thickened outwardly, and abruptly attenuated to a pointed apex; the area below and behind this ochreous; two narrow white longitudinal streaks; one on fold from near base to about two-thirds, suffused distally; and one from base of dorsum to tornus, nearly straight, running below the fold; dorsum white except about the tornus; a suffused large white mark in disc sending two suffused branches outwards, the lower one reaching the termen just below apex, the upper one towards costa just before apex; cilia yellow at apex, white below, then becoming grey with ochreous basal shade. *Hind wings* grey; cilia paler, a darker basal shade around apex.

Hab. JAPAN: 6 ex., Mt. Iwawakisan, Osakafu, 25. vi. 1920 (*author*); 1 ex., Katayama, Gifuken, 20. vi. 1919 (*K. Takeuchi*).

Gracilariadæ.

Gracilaria albicapitata, sp. n.

♂ ♀.—11–12 mm. *Antennæ* white, ringed fuscous except at the base. *Palpi* white, second segment with dark fuscous tip, and a broad fuscous band laterally, third segment with a broad dark fuscous subapical band. *Head* and *face* snowy white. *Thorax* snowy white, dark fuscous anteriorly. *Abdomen* greyish fuscous. *Legs*, posterior tibiaæ greyish fuscous, suffused with white; spurs white; tarsi white, tips of each segment dark fuscous, basal part of first segment also dark fuscous. *Fore wings* broad, elongate, apex obtuse; Cu_{1a} present; snowy white, with six fasciæ of ochreous yellow edged and irrorated with dark fuscous; basal area irregularly irrorated with dark fuscous on costal half; first fascia from dorsum about one-third towards costa at one-fourth, suffused and irrorated with dark fuscous below costa; second fascia from costa before middle to dorsum beyond middle, well defined, broadest on the fold; third from costa beyond middle to dorsum before tornus, a little narrower than the second; fourth from costa at three-fifths to tornus, irrorated with dark fuscous; space between this and preceding fascia very narrow on costal half and interrupted by a dark fuscous cloud at middle; fifth from five-sixths of costa to termen above tornus, almost fused with fourth at dorsal third; space between this and preceding fascia forming an acute triangular costal blotch containing an irregular dark fuscous costal dot; the sixth fascia occupying the apical space, the inner margin rounded; the space between this and preceding fascia forming a narrow semicircular white streak; cilia greyish fuscous, irrorated with dark fuscous, a paler median band. *Hind wings*, apex obtuse; Cu_{1a}

present, R_s widely remote from M; greyish fuscous; cilia greyish fuscous.

Hab. JAPAN: 4 ex., Sapporo, v.–vi. 1918 (*author*).

Lithocolletis nipponicella, sp. n.

♂ ♀.—7–8 mm. *Antennæ* pale yellowish white, basal segment smooth, thick; white. *Palpi* white. *Head*, tuft white, mixed yellow laterally; *face* silvery white. *Thorax* shining light golden ochreous, with median white streak; *tegulæ* white. *Abdomen* pale grey, anal tuft white. *Legs*, posterior tibiæ, its dorsal tuft, and tarsi greyish white. *Fore wings* broad, lanceolate; $R_{4 \cdot 5}$ and $M_{1 \cdot 2}$ simple; shining light golden ochreous; a slender white costal line from base to a little beyond one-third, slightly thickened towards posterior extremity; a slightly shorter narrow straight white median streak from base, edged above with dark fuscous scales; a white dorsal streak from base to one-third; a broad gently curved silvery white median fascia, widest on dorsum, anteriorly edged with dark fuscous scales, and emarginate in disc, posteriorly suffused; three small wedge-shaped indistinct shining white costal marks posteriorly, slightly dark-edged anteriorly; a triangular dorsal spot on tornus, anteriorly edged with dark fuscous; an indistinct narrow dorsal whitish spot on termen above tornus; a black apical spot; cilia bronzy ochreous, a blackish fuscous median line, outer half greyish white, entirely greyish white on tornus. *Hind wings* grey; cilia whitish.

Hab. JAPAN: 1 ex., Hasimoto, Wakayamaken, 12. viii. 1920 (type); 2 ex., ditto, 17. iv. 1920; 2 ex., Mt. Iwawakisan, Osakafu, 24. iv. 1920; 2 ex., Sapporo, 27. v. 1919. All specimens collected by author.

TINEIDES. (ACULEATA.)

Incurvariadæ.

Eriocottis flavicephalana, sp. n.

♂.—17–18 mm. *Antennæ* fuscous; ocelli rudimentary. *Labial palpi* slender, besides three segments with distinct palpiger, which are fused together at the base; porrect or slightly ascending in dried specimens; second segment rough; third segment a little longer than the first, but shorter than the second, with appressed scales; fuscous yellow. *Maxillary palpi* slender, a little shorter than the labial, with five segments, folded, fourth longest, fifth very short, pointed; *rostrum* rolled. *Head* rough, with long pale yellow hairs. *Thorax* bronzy fuscous. *Abdomen* dark fuscous. *Legs*, posterior tibiæ greyish brown, in some specimens yellowish; tarsi greyish brown, segmental margins yellowish. Wing venation typical. *Fore wings* elongate, little dilated posteriorly, costa gently arched, apex round-pointed, termen slightly rounded, oblique; bronzy yellow; veins fuscous, crossed by a network of innumerable fine lines of the same colour; an obscure fuscous mark on dorsum beyond middle; an ill-defined fascia of the same colour from costa just beyond middle to tornus; on the dorsal area before and beyond this fascia more or less yellowish; cilia dark bronzy fuscous, yellow on tornus. *Hind wings* dark fuscous; cilia dark fuscous, a darker basal shade, becoming paler towards tornus.

Hab. FORMOSA: 3 ex., Mt. Rantaisan, 6500 ft., 11. iii. 1926 (*author*), containing type (and 3 ex. in spirit); 1 ex., Keinansan, 5000 ft., Takaosyû, 13. iii. 1929 (*author*).

Adelidæ.

Nemophora bifasciatella, sp. n.

♂ ♀.—12–14 mm. *Antennæ*, ♂ 3½, ♀ 1⅓, simple; fuscous bronzy. *Palpi* minute, clothed with rough hairs; ochraceous. *Head* clothed with rough hairs; *face* dark bronzy; *eyes* rather small, remote. *Thorax* dark bronzy. *Abdomen* dark fuscous with bronzy reflections. *Legs*, posterior tibiæ and tarsi ochraceous bronzy, faintly ringed at their segmental margins. *Fore wings* elongate, narrow, a little dilated posteriorly, costa nearly straight, arched posteriorly, apex obtuse, termen slightly rounded, oblique; R_3 and R_4 separate; basal third ochreous bronze; dark ochreous yellow beyond; a fine blackish streak along basal half of costa; a rather straight narrow transverse fascia from before middle of costa to beyond two-thirds of dorsum, violet-leaden metallic, edged with blackish brown; a similar fascia at three-fourths from costa to tornus, strongly curved inwards about the middle; area between these ochraceous; a broad purple-bronzy line round apical portion of costa and termen to extremity of fascia; cilia fuscous bronze. *Hind wings* dark fuscous, purplish posteriorly; cilia dark fuscous, with an ochraceous basal line.

Hab. JAPAN: 3 ♂ ♂, 3 ♀ ♀, Kawamata, Totigiken, 1. viii. 1922 (*author*); 4 ♂ ♂, 1 ♀, Kuzu, Naganoken, 12. vii. 1919 (*K. Takeuchi*); 1 ♂, Tesio, Hokkaido, vii. 1916 (*author*).

Nemophora albiantennella, sp. n.

♂ ♀.—13–15 mm. *Antennæ* in ♂ 3½, thick, white, except basal fifth, which is dark fuscous with purple reflection, basal segment cupric golden; ♀ 1⅓, basal half thickened with blackish purple-bronze scales. *Palpi* minute, without hairs; fuscous. *Head* clothed with ochreous hairs; *face* blackish purple-bronze; *eyes* small, widely remote. *Abdomen* blackish bronzy. *Fore wings* moderate, costa gently arched, apex rounded, termen rounded, a little oblique; R_3 and R_4 separate; basal two-fifths bronzy golden, purplish on costa and dorsum; dark bronzy purple beyond, its inner part forming an ill-defined broad dark purple band, suffused outwardly; cilia dark fuscous with bronzy reflections. *Hind wings* dark bronzy purple; cilia dark fuscous.

Hab. JAPAN: 4 ♂ ♂ (type ♂), Katayama, Gifuken, 10. vi. 1919 (*K. Takeuchi*); 1 ♀, Ikeno, Gifuken, 5. v. 1919 (*K. Takeuchi*); 1 ♂, Mt. Mitake, Tokyofu, 10. v. 1925 (*S. Hirayama*).

XLVII.—*New and rare Mantodea (Orthoptera) in the British Museum.* By Dr. MAX BEIER, Vienna.

THROUGH the kindness of Mr. B. Uvarov I have received for study a large collection of Mantodea belonging to the British Museum and the Imperial Bureau of Entomology, and consisting of numerous specimens, not only of very interesting and already known species but also of a number of new ones which are described in the following pages.

Amorphoscelis nigriventer, sp. n.

♂. The head, except the throat, and the pronotum yellowish, the entire underside and all the coxæ blackish brown. The frontal scutellum transverse, its upper margin sinuated at each side, produced and slightly sinuate in the middle. The tubercles of the temples smooth. Palpi yellowish, only the basal and the distal joints brownish. The yellow antennæ black-ringed. The pronotum wider than long, with two obtuse tubercles near the anterior margin and two near the posterior margin. Tegmina transparent, their base and stigmatic region brownish, the costal field subopaque, with a series of brownish spots. Wings transparent, with indistinct small brownish spots in their costal field. The front femora blackish in the lower half of the inner side. Tibiæ blackish inside, except the base. The middle and hind legs with brownish rings on their femora and tibiæ. The joints of the tarsi with black tips. Cerci long, their last joint expanded, oval, a little more than twice as long as broad.

Length of body 17, pronotum 2, width of pronotum 2·2, length of tegmen 15 mm.

Type. ♂, Gold Coast, Bibianaha, Sept.–Dec. 1909 (*Dr. Spurrell*).

Allied to *A. pulchella*, G.-Tos, but differing in the form of the frontal scutellum, in the smaller pronotum, and in the shorter tegmina and their colouring; easily distinguishable by its colour from *A. simulans*, G.-Tos, and *A. horni*, Werner.

Eremiaphila gigas, sp. n.

♀. Body very large and strong. General colour brownish yellow. The pronotum square, its lateral margins rounded; the fore angles of the pronotum very distinctly produced outwardly and pointed, the hind angles projecting but rounded. Tegmina short, opaque, densely reticulate. Wings short. The fore coxæ strong, black, smooth and shiny on their inner side except the tip, which is narrowly pale; the inner margin of the coxæ finely denticulate. The front femora with a large black stripe from the base to the middle; the two distal spines at the inner margin of the femora larger than the others. The front tibiæ with four external spines. The middle and hind legs smooth, without spinules, their tibiæ with indistinct darker rings at the base and at the tip. The claws of the legs unequal, owing to the inner claw being a little longer and thicker than the outer one.

Length of the body 53, length of pronotum 10, width of pronotum 10, length of tegmen 13, length of fore coxæ 10, of hind femora 25 mm.

Type. ♀, Sudan, Nikeila, 1. xii. 1927 (*Shaw*).

The new species is allied to *E. typhon*, Lefv., but differs in the larger size of the body and pronotum, in the angles of the pronotum, in the front tibiæ having four external spines only, and in the smooth middle and hind legs.

Oxyelæa heteromorpha, sp. n.

♂. Colour pale brownish. Head wider than the pronotum. The frontal scutellum transverse and rounded on its upper margin. The vertex without tubercles, but uneven. The eyes large, oval, with a short and obtuse spine above. The pronotum widening from the base to the anterior margin, the supracoxal dilatation distinct, rounded, the shaft with two transverse furrows above; the tubercles of the pronotum are flat and indistinct, not so well developed as in *O. elegans*. The tegmina vitreous, the transverse veins of their discoidal field thickened and dark brown on the basal half, the longitudinal veins for the most part brown. Wings vitreous, the base of the transverse veins at the tip of the wings brownish. Front limbs: coxæ yellowish, trochanters with a black dot inside; femora with four discoidal and four external spines; two of the latter are near the base and two near the tip, the large intervening space unarmed; a triangular spot near the tip and little dots on the base of the great internal spines of the femora are brown. Tibiæ with seven external spines. The long ceri projecting somewhat beyond the large subgenital plate.

Length of body 20, pronotum 4, the greatest width of pronotum 3, length of tegmen 19 mm.

Type. ♂, Kenya Colony, Maziwa Mitatu and Maungu, 14. iii., 4. iv. 1897 (*C. S. Betton*).

I think that the new species, in spite of the different shape of the head and of the pronotum, belongs to the genus *Oxyelæa*, Giglio-Tos's description of which was based on the only species known to him.

Humbertiella laosana, sp. n.

♀. Colour yellowish brown with irregular and indistinct darker spots. The forehead with a black transverse line, which is interrupted in the middle. The pronotum with three distinct but low anterior tubercles; the two posterior tubercles are indistinct. The lateral margins of the pronotum smooth, only in the region of the fore and hind angles finely denticulate. Tegmina opaque, spotted with yellowish and blackish, with a larger yellowish spot on the stigma. Wings blackish, their veins and tip yellowish. The front coxæ yellow with a black band near their apex. Front femora with a large and uninterrupted black band from the base to the apex in their lower half, with black dots at the base of the larger internal spines and with a black spot between the discoidal and the two basal external spines. The spines of the femora are black only on their tips. Tibiæ with nine external and ten internal spines, the latter with a black basal ring. The middle and hind legs with three irregular darker rings on their femora and tibiæ; the tarsal joints blackish at the tips, the first joint also blackish at the base.

Length of body 40, pronotum 9·5, its width 7, length of tegmen 25 mm.

Type. ♀, French Laos, Bandat, 1920–24 (*J. F. Godfrey*).

Easily distinguishable from the closely allied *H. ceylonica*, Sauss., and from the other species by the coloration of the front femora.

Tarachodes robustus, sp. n.

♂. Colour yellowish brown. The frontal scutellum with a blackish transverse line in the middle. The crown with incisions near the eyes and four small and low tubercles between. Pronotum nearly smooth, slightly granulate only behind the supra-coxal furrow, its front angles broadly rounded, armed with three or four rather large teeth, and behind these with one or two small ones. The lateral margins unarmed except before the hind angles, where they are finely denticulate. The tegmina and wings subdiaphanous, their veins spotted with black. The underside of the pronotum yellow, only with a small black band near its base.

Front limbs: coxæ entirely yellow, trochanters yellow, with a darker spot inside; femora yellow, with the lower part of their inner side darker but not black, on the outside blackish granulate; tibiæ entirely yellow. The abdomen without black spots.

Length of the body 50, pronotum 12, width of the pronotum 6·5, length of the tegmen 37·5 mm.

Type. ♂, Nigeria, Northern Province, Matyoro Lakes, 25 miles N. of Gombe, iii. 1928 (*Dr. Ll. Lloyd*).

Allied to *T. gilvus* (Charp.) and *T. feæ*, G.-Tos, but distinguishable by the colour of the front legs, by the structure of the head and pronotum, and by the longer tegmina.

PARAGALEPSUS, gen. nov.

In shape very similar to the genus *Galepsus*. Head with the eyes a little broader than the pronotum. Frontal scutellum nearly as high as broad. Vertex straight, a little concave in the middle; two conical tubercles near the eyes. Eyes oblong, with parallel lateral margins and pointed front angles, not projecting above the vertex. Pronotum in front a little wider than behind, with broadly rounded angles and smooth lateral margins, about twice as long as broad. Tegmina and wings as long as the abdomen, transparent. Front coxæ projecting beyond the hind margin of the pronotum. Femora with four discoidal and four external spines, tibiæ with eleven to fourteen external spines. Supra-anal plate transverse, rounded. Cerci long, flat.

Tropical Africa.

This new genus, which is characterized by the front coxæ projecting beyond the hind margin of the pronotum, by the parallel lateral margins and the pointed front angles of the eyes, and by the shape of the vertex and the flat cerci, occupies an intermediate position between *Tarachodes* and *Galepsus*.

Paragalepsus nigericus, sp. n. (Fig. 1, A.)

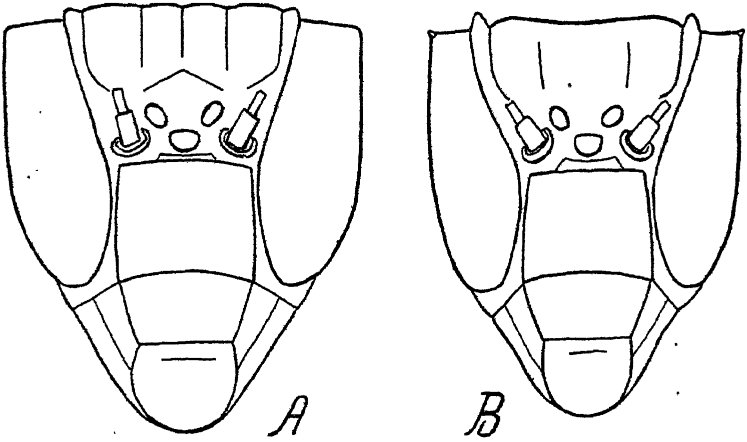
♂. Colour brownish or yellowish brown. Frontal scutellum a little broader than high. Vertex straight, very indistinctly concave in the middle; between the deep lateral furrows and the eyes a conical tubercle not surpassing the vertex. Eyes with parallel lateral margins and nearly rectangular fore angles. Pronotum nearly twice as long as wide, its lateral margins smooth, the supra-coxal dilatation indistinct. Prosternum with a large black spot in the shaft region. Tegmina and wings transparent. The fore legs entirely yellow, their tibiæ with thirteen to fourteen external spines. All tarsal joints slightly blackish at the tip.

Length of the body 31–32, pronotum 7, its shaft 4·8, width of the pronotum 3, length of tegmen 19–21 mm.

Type. ♂, Nigeria, Northern Province, Mama Dist., Akwanga Div., ii. 1928 (*Dr. Ll. Lloyd*).

Paratype. A ♂ from the same locality.

Fig. 1.



A. *Paragalepsus nigericus*, gen. et sp. n., ♂, head.
B. *Paragalepsus oxyops*, sp. n., ♂, head.

Paragalepsus oxyops, sp. n. (Fig. 1, B.)

♂. Very similar to the preceding species, but a little smaller. Frontal scutellum as high as broad, vertex distinctly concave in the middle. The conical tubercles between the lateral furrow and the eyes a little higher than the vertex. The rectangular front angles of the eyes with a short spinelet. Front tibiæ with eleven external spines only. All the other characters as in the preceding species.

Length of body? (tip of abdomen broken off in case of type), pronotum 6, width 2·5, tegmina 20 mm.

Type. ♂, Uganda, Kamule, 20. xii. 1921 (*H. Hargreaves*).

Galepsus capensis, sp. n.

♂. Colour brownish, with a number of darker spots and dots. Head wider than pronotum, vertex somewhat convex, with two longitudinal furrows near the eyes. Eyes rounded, globulate. Frontal scutellum transverse, nearly twice as long as high, its upper margin regularly rounded, not angulate in the middle. Pronotum much narrowed towards the base, with smooth lateral margins. Tegmina and wings diaphanous, as long as the abdomen. Fore coxæ smooth and entirely yellow; trochanters with a black dot inside; femora with four discoidal and four external spines; a small spot on the base and a larger one behind the claw-furrow black; the spines yellow, the tips only blackish; tibiæ with a darker longitudinal line inside.

Length of body 22, pronotum 4, its shaft 3, width of pronotum 2, length of tegmen 17, fore coxæ 3 mm.

Type. ♂, S. Africa, Cape Province, Ceres, ii. 1925 (*R. E. Turner*).

The new species is easily recognizable by the form of the head and the pronotum; the pronotum is similar to that of *G. madagascariensis*, Serv., but shorter; the species also resembles the genus *Antistia*, but the shaft of the pronotum is longer (as long as the cephalic coxæ). The new species is perhaps related to *G. femoratus* G.-Tos.

Orthoderina straminea, Sjöst.

Orthoderina straminea, Sjöstedt, Ark. zool. xi. p. 16, t. iv. fig. 4 *a–c* (1918).

This interesting and apparently very rare species, which is only known in the male sex, is represented in the British Museum by a female from Australia, Northern Territories, Groote Eylandt, 27. ii. 1925 (*G. H. Wilkins*). This specimen agrees fairly well with Sjöstedt's description, but has the tegmina opaque, the cephalic tibiae with nine inner and eleven outer spines; the body a little larger. The description of this female is as follows:—

♀. General colour green. Head very flat, with a dorsal furrow on each side near the eyes. Frontal scutellum higher than broad, pentagonal. Eyes projecting, conical, but less tapering than in the male. Pronotum about two-and-a-half times as long as broad, a little narrowed behind, sparsely granulate above, its dorsal keel indistinct. Tegmina opaque, wings vitreous. The fore coxæ finely granulate at the inner margin, the median part of the inner side reddish. Front femora with a black spot at the claw-furrow, with four discoidal and four external spines; spines greenish, with their tips only blackish. Fore tibiæ with nine external and eleven internal spines.

Length of body 35, of pronotum 11, its shaft 7·5, anterior width of pronotum 4, width of head 5, length of tegmen 28, fore coxæ 7 mm.

Bolbella rhodesiaca, sp. n.

♂. Colour grey-brown. Head transverse, vertex moderately arcuate. Frontal scutellum transverse, its upper margin regularly arcuate. Pronotum longer than wide, the supra-coxal dilatation distinct, with almost angulate edges; shaft of the pronotum with an indistinct and posteriorly abbreviate keel, and with two little, lateral, wart-like tubercles; lateral margins nearly smooth. Tegmina and wings longer than the abdomen, brownish, with false veins, longitudinal veins with darker brown spots and dots. Front femora with three discoidal and four external spines. Tibiæ with nine external and nine internal spines.

Length of body 17, pronotum 3·2, greatest width of pronotum 1·8, tegmen 17 mm.

Type. ♂, S. Rhodesia, Mt. Chirinda, x., xi. 1911 (*C. F. M. Swynnerton*).

Differs from *B. punctigera*, Stål, in the more strongly angulate supra-coxal dilatation of the pronotum and the darker and more heavily spotted tegmina.

Nilomantis arabica, sp. n.

♂. Colour green. Vertex straight, with two little incisions on each side. Eyes obtusely conical. Frontal scutellum transverse, very narrow. Forehead with a reddish-brown transverse spot on each side between the superior ocelli and the eyes. Pronotum as long as the front coxæ, two-and-a-half times as long as wide, its supra-coxal dilatation rounded, not very distinct. Shaft of the pronotum and base of the collar with a distinct keel above. Lateral margins smooth. Tegmina and wings longer than the abdomen, vitreous, with green veins. Front femora with three discoidal and four external spines; no short spine between the two last internal spines. Tibiæ with twelve external spines. Cerci long, much longer than the supra-anal plate.

Length of body 20, pronotum 5, its shaft 3, width of pronotum 1·8, length of tegmen 18, width 4·5 mm.

Type. ♂, Muscat, Pass of Khubain, 1926 (*J. Fernandez*).

The genus *Cryptomantis*, G.-Tos (1915), is identical with *Nilomantis*, Werner (1907). Werner described the eyes of *Nilomantis* as rounded; they are, however, distinctly conical, as I found on examining the type. Since the supposed difference in the shape of the eyes is the only generic difference between *Nilomantis* and *Cryptomantis*, the latter name becomes a synonym of the former. Moreover, the pronotum of the typical specimen is not 2·5 mm. long, as Werner says, but 3·5 mm., and thus more than twice as long as broad.

Nilomantis arabica differs from the two previously known species, *N. floweri*, Werner, and *N. tenella* (G.-Tos), in the body being larger, and in the presence of the two reddish-brown spots between the ocelli and the eyes.

Amantis aliena, sp. n.

♀. Brownish. Frontal scutellum a little broader than high, rounded above. Crown with very indistinct darker spots. Pronotum with a darker median line. Tegmina brownish, subtransparent, with fairly thick veins; transverse veins not thickened at their base; false veins and a black dot behind the stigma present. Front coxæ yellow, with two blackish dots on their tips. Femora yellow, their base inside and three transverse stripes outside darker. Metatarsus black only at the tip.

Length of body 17, pronotum 4, tegmen 15 mm.

Type. ♀, Tenasserim (presented by the late *Col. C. T. Bingham*).

To be distinguished from the allied species, *A. reticulata* (Haan) and *A. bolivarii*, G.-Tos, by the transverse veins of the tegmina not being thickened at the base; the tegmina are longer and darker than in *A. reticulata*, and shorter than in *A. bolivarii.*

Amantis longipennis, sp. n.

♂. General colour brownish. Frontal scutellum a little broader than high, with two indistinct keels, its upper margin rounded. Occiput with indistinct darker stripes. Antennæ brownish, yellowish at their base. Pronotum as usual, the median longitudinal stripe indistinct. Tegmina fairly long, brownish, subdiaphanous, with false veins, transverse veins thickened and brownish at their base; stigma with a black dot behind. Fore legs: coxæ yellowish, their tips only with one or two black dots on the inner side; yellowish femora spotted with blackish; tibiæ with three black rings; first tarsal joint entirely black, the other tarsal joints yellow.

Length of the body 16, pronotum 3·8, tegmen 17 mm.

Type. ♂, Tonkin, Bao Ha., x.–xii. 1923 (*H. Stevens*: Sladen–Godman Trust Exped.).

Paratype. A ♂ from the same locality.

Related to *A. reticulata* (Haan) and *A. biroi*, G.-Tos. Differs from the former species in the longer and infuscated tegmina, from the latter species in the longer tegmina and in having the black dot behind the stigma. *A. æta*, Heb., which is also related to the new species, has the tegmina entirely diaphanous.

Gonypeta simplex, sp. n.

♂. Colour brownish. Frontal scutellum about as long as broad, uniformly coloured. Pronotum as in *G. punctata* (Haan), but the supra-coxal dilatation a little less marked. Tegmina subdiaphanous, with a number of brown dots, especially at their tips, and with two irregular brown spots before and behind the stigma, their costal field darker and opaque. Wings transparent, their tips speckled with brown; second general branch of the media bifurcate. Fore legs yellowish brown, coxæ at their tips, trochanters, base of the femora, a longitudinal stripe on the inner side of the latter, and three transverse lines of the tibiæ blackish; metatarsus blackish at its base and tip, yellowish in the middle. Front coxæ with granulate inner margin, femora with a series of little granules exteriorly.

Length of body 22, of pronotum 4·8, width of pronotum 2·4, length of tegmen 19 mm.

Type. ♂, Singapore, 1903 (*H. N. Ridley*).

Closely allied and very similar to *G. punctata* (Haan), but with the second general branch of the media bifurcate, while in *G. punctata* this vein is trifurcate. Differs also a little in the colour of the front legs, and not so dark.

HALDWANIA, gen. nov.

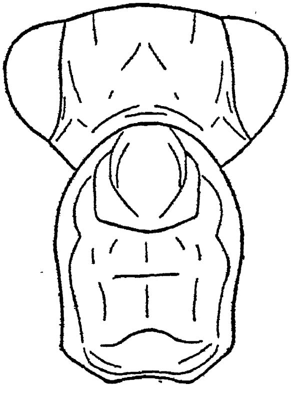
♂. Body very small. Head with great rounded eyes. Frontal scutellum transverse, a little more than twice as long as broad. Pronotum short, with nearly parallel lateral margins, its supra-coxal dilatation very indistinct, its anterior margin curved and insensibly passing into the lateral margin. Collar of the pronotum but a little shorter than the shaft. Tegmina and wings well developed and longer than the abdomen. Front coxæ a little longer than the pronotum, projecting much beyond its base. Front femora with four discoidal and four external spines, slightly denticulate between the latter. Tibiæ with nine external spines. First joint of the hind tarsi nearly as long as the other tarsal joints. Supra-anal plate transverse. Cerci long, conical.

The new genus belongs to the *Gonypetæ*, but differs from all other genera in the nearly Eremiaphilinæ-like pronotum with its almost parallel sides, the very indistinct supra-coxal dilatation, and the very small body.

Haldwania liliputana, sp. n. (Fig. 2.)

♂. General colour pale brownish. The head with two longitudinal stripes composed of brown dots on the vertex, and with a number of brown dots near the eyes. Pronotum about only one-and-a-half times as long as broad, its lateral margins very thin and sparsely denticulate with brown; surface of the pronotum almost smooth, its shaft with two indistinct lateral longitudinal spots. Tegmina and wings brownish, transparent, with false veins; longitudinal veins with indistinct darker brown dots. Front legs: coxæ nearly smooth on the inner margin, with five or six very small teeth and a number of fine hairs; their outside entirely and their inner side at the tip black. Femora with three black longitudinal stripes on the inner side—one above, one on the lower spiny margin, and one in the middle—connected at the base of the femur; a black triangular spot arising from the upper margin and connecting the upper and the middle stripes at half of their length. The first three tarsal joints black on the inner side, the two last joints yellowish. Middle and hind legs entirely yellowish.

Fig. 2.



Haldwania liliputana, gen. et sp. n., ♂; head and pronotum.

Length of body 11, pronotum 2·1, its shaft 1·1, width of pronotum 1·5. length of tegmen 9·5 mm.

Type. ♂, India, Haldwania Dist., Kumaon, 1923 (*H. G. Champion*).

A very interesting species, easily recognizable by its unusually small size.

Gonypetella atrocephala, sp. n.

♂. Front coxæ, trochanters, and femora black, the latter with two lighter spots on the upper margin; head entirely black, except the frontal scutellum, the clypeus, and the labrum, which are reddish brown; pronotum brownish, its lateral margins and a wide longitudinal line in the middle black; body and middle femora entirely, hind femora at their base and tips black. Frontal scutellum transverse, its dorsal margin curved. Pronotum with supra-coxal dilatation well marked but rounded, its lateral margins smooth. Tegmina long, projecting much beyond the tip of the abdomen; the longitudinal veins of the tegmina and wings with black spots. The last spine on the inner margin of the front femora slightly longer than the preceding spines. Four discoidal and external spines. Tibiæ with seven external spines.

Length of body 18, length of pronotum 2·5, greatest width of pronotum 1·7, length of tegmen 20, of fore coxæ 3 mm.

Type. ♂, Transvaal, Johannesburg, Bloksberg, 1907 (*C. H. Pead*).

Closely related to *G. fuscipes* (Sjöst.), *G. kilimandjarica* (Sjöst.), and *G. deletrix*, Rehn, but differing very markedly, especially in the colour of the head and the much longer tegmina.

Gonypetella uvarovi, sp. n.

♂. General colour brown. Head in the occipital region with three black longitudinal stripes. Frontal scutellum, clypeus, and labrum brown, minutely speckled with black. Antennæ yellow, distally brownish, their basal and second joints black. Pronotum as usual in the genus; black lateral margins and median stripe indistinct. Tegmina subdiaphanous, much longer than the body, their longitudinal veins with black dots, transverse veins brownish. Front legs reddish brown, trochanters and base of femur darker. Middle and hind legs light brown, without black rings. Tarsal joints darker at the tips.

Length of body 17, of pronotum 2·5–2·6, greatest width of pronotum 1·4, length of tegmen 17–18, length of fore coxæ 3 mm.

Type. ♂, British East Africa (Kenya Colony), Mogorr R. Valley, vi. 1913 (*A. O. Luckman*).

Paratypes. 1 ♂, British East Africa (Kenya Colony), Ngare Narok, Masai Reserve, about 6000 ft., 31. xii. 1913 (*A. O. Luckman*) ; 1 ♂, British East Africa (Kenya Colony), Escarpment, 6500–9000 ft., iii., iv. 1901 (*W. Doherty*).

I have much pleasure in dedicating this species to Mr. B. Uvarov.

The new species is allied to *G. flavicornis* (Sjöst.), but distinguishable by the colour of its antennæ, the length of the tegmina, and the brownish transverse veins.

Musonia boliviana, sp. n.

♂. Colour brownish. Frontal scutellum narrow, its upper margin truncate, with a small incision in the middle. Antennæ pubescent. Pronotum narrow, its lateral margins finely denticulate, shaft with a distinct keel. Tegmina and wings transparent, the former with dark stripes between the longitudinal veins ; transverse veins of the tegmina thickened at their base ; false veins present. Front coxæ a little shorter than the shaft of the pronotum, their margins nearly smooth. Femoral furrows situated in the middle. Tibiæ with five external spines. Supra-anal plate produced, triangular, pointed, twice as long as its basal breadth. Cerci much longer than the supra-anal plate.

Length of body 40, pronotum 9, shaft of pronotum 6·5, greatest width of pronotum 1·5, length of tegmen 24, fore coxæ 6, hind femora 14, supra-anal plate 2·5 mm.

Type. ♂, Bolivia, 1905 (*J. Steinbach*).

Allied to *M. seclusa* (Rehn), of Argentina, but differing in all parts of the body being considerably larger.

Thespis major (G.-Tos) ?.

Diamusonia major, G.-Tos, Bull. Ent. Ital. xlvii. p. 7 (1916).

The British Museum collection possesses two male specimens of a *Thespis* which I take to be *Th. major* (G.-Tos), of which the male is as yet unknown, because these examples are larger than the males of the other species. The measurements are:—Length of body 53, pronotum 17, its shaft 13, width of pronotum 2·5, length of tegmen 27, front coxæ 9, hind femora 20 mm.

The specimens are from Colombia, Lake Sapatoza region, Chiriguana District, viii.–xi. 1924 (*C. Allen*).

Leptomiopteryx argentina, sp. n.

♂. Colour brownish. Eyes rounded, frontal scutellum transverse, narrow. Shaft of pronotum and the last half of its collar with a distinct median keel, the lateral margins finely and densely denticulate. Tegmina shorter than the abdomen, transparent, the transverse veins a little enlarged at their base; tip of tegmina and wings narrowly rounded, nearly pointed. Front legs weak, their coxæ smooth, about as long as the shaft of the pronotum; the femora with four discoidal and four external spines, the claw-furrow situated behind the middle; tibiæ with five external and nine internal spines. Supra-anal plate long, triangular, pointed. Anterior margin of the tegmina and antennæ hairy.

Length of the body 49, pronotum 10, its shaft 7, width of the pronotum 1·5, length of tegmen 21, of fore coxæ 6·5 mm.

Type. ♂, Argentine Republic, Villa Ana, F.C.S.F., ii. 1926 (*K. J. Hayward*).

Differs from *L. dispar*, Chop., in the longer pronotum and shorter tegmina.

Hoplocorypha ugandana, sp. n.

♂. Colour dark brownish. Pronotum finely granulate above and on the lateral margins, its shaft with three distinct keels. Tegmina and wings infuscated with brownish, subtransparent, without darker spots or stripes; black costal field of the tegmen anteriorly bordered with white. Front femora with a blackish spot at the base of the discoidal spines; the femora themselves pale, their tips alone brown. Supra-anal plate longer than broad, as long as the cerci, a little tapering towards the apex, with straight lateral margins; apex of the supra-anal plate a little rounded, almost truncate.

Length of body 37, pronotum 11·5, its shaft 8, tegmen 17, front coxæ 6 mm.

Type. ♂, Uganda, Chua, xi.–xii. 1925 (*Dr. G. D. H. Carpenter*).

Related to *H. macra* (Stål), but differing in the darker colour of the body, darker brownish tegmina, and broader, nearly truncate supra-anal plate.

Hoplocorypha distinguenda, sp. n.

♂. Colour brownish. Pronotum granulate, its lateral margins denticulate, the shaft with two lateral keels, the median keel indistinct. Tegmina brownish, rather opaque, but without darker stripes or spots ; costal field black, with the anterior margin white. Wings dark, much infuscated, blackish. Front femora with a black stripe on the inferior margin of the inner side, and a black spot at the base of the discoidal spines ; tibiæ blackish at their tips and in the middle. Supra-anal plate longer than broad, a little longer than the cerci, its lateral margins parallel or a little divergent towards the apex, which is broadly rounded.

Length of body 40, pronotum 12, its shaft 9·5, tegmen 17, front coxæ 6 mm.

Type. ♂, N. Nigeria, Azare, vi. 1924 (*Dr. Ll. Lloyd*).

Allied to *H. garuana*, G.-Tos, but larger, and the median keel of the shaft of the pronotum indistinct ; wings darker and more infuscated.

Hoplocorypha striata, sp. n.

♂. Colour grey-brown. Pronotum with fine blackish granules above, shaft with three distinct keels, lateral margins finely denticulate. Tegmina shorter than the abdomen, subtransparent, discoidal field with uninterrupted darker stripes between the longitudinal veins ; the black costal field bordered with white. Wings without darker longitudinal stripes. Legs as usual in the genus. Supra-anal plate longer than broad, but distinctly shorter than the cerci, tapering somewhat to the apex, distinctly truncate, and without incision.

Length of body 37, pronotum 11·5, shaft of pronotum 8, tegmen 19, front coxæ 5·5 mm.

Type. ♂, S.W. Africa, Okahandja, 10–16. ii. 1928 (*R. E. Turner*).

This species is easily recognizable by the darker longitudinal stripes of the tegmina and the truncate supra-anal plate.

Hoplocorypha turneri, sp. n.

♂. Colour yellowish brown. Lateral margins of the pronotum finely denticulate ; median keel of the shaft of the pronotum indistinct, but the lateral keels very distinct ; pronotum finely granulate above. Tegmina subdiaphanous, shorter than the abdomen, their discoidal field with a number of irregular brown spots or dots ; the costal field as usual, that is, blackish, with a white stripe on the costal margin. Supra-anal plate almost triangular, with the lateral margins rounded, pointed at apex.

Length of body 32, pronotum 9·5, its shaft 6·8, tegmen 15, front coxæ 4·5 mm.

Type. ♂, S.W. Africa, Okahandja, 10–16. ii. 1928 (*R. E. Turner*).

Hoplocorypha turneri is related to *H. foliata*, G.-Tos, but differs in the shorter pronotum and tegmen and in the indistinct, almost absent, median keel of the shaft of the pronotum.

Hoplocorypha nigerica, sp. n.

♂. General colour pale yellowish brown. The head as usual. Pronotum long and thin, its shaft with three keels above, the lateral margins finely denticulate. Tegmina shorter than the abdomen, vitreous, without darker spots or stripes on the discoidal field ; costal field blackish, with a white line on the costal margin. Cephalic coxæ shorter than the shaft of the pronotum. Front femora with four external and three discoidal spines. Supra-anal plate at its base about as broad as long, as long as the cerci, distinctly tapering to the apex, which is broadly and uniformly rounded, without incision.

Length of body 36, pronotum 11·5, its shaft 8, tegmen 15, front coxæ 6 mm.

Type. ♂, N. Nigeria, Azare, vi. 1924 (*Dr. Ll. Lloyd*).

Allied to *H. macra* (Stål), but differing in the shorter tegmina and the broader supra-anal plate, which is more broadly rounded at the apex.

Bantiella fusca, G.-Tos.

Bantiella fusca, Giglio-Tos, Bull. Soc. Ent. Ital. xlvi. p. 187 (1915).

I cannot find any difference between this species, the type of which was taken in Trinidad, and four male specimens from British Guiana, Kartabo, vi.–ix. 1923 (*M. D. Haviland*). *B. fusca* would therefore appear to be widely distributed.

Thrinaconyx fumosa, Sauss. & Zehnt.

Thrinaconyx fumosa, Saussure & Zehnter, Biol. Centr.-Amer., Orth. i. p. 179 (1894).

This species, known to occur in Panama, is represented in the British Musuem collection by a male from Gorgona I., 2° 59′ N., 78° 20′ W., xi. 1924 (*Miss L. E. Cheesman*).

Thesprotia brevis, G.-Tos.

Thesprotia brevis, Giglio-Tos, Bull. Soc. Ent. Ital. xlvi. p. 196 (1915).

Only known to be found in Paraguay. The British Museum has two males from the Argentine Republic, Villa Ana, F.C.S.F., i., iii. 1925 (*K. J. Hayward*).

Oxypilus distinctus, sp. n.

♂. Frontal scutellum with a small pointed tubercle on the upper angle. Ocellar tubercles small and blunt. Appendage of the head and pronotum as usual. Tegmina rather short, transparent, their longitudinal veins entirely and the transverse veins at the base brownish, but the false veins pale; tips of all the longitudinal veins of the tegmina and wings with a dark brown spot. Front coxæ armed on the inner margin with fairly long and entirely pale spines, and adorned with four to five blackish stripes on the inner side, their last fourth only yellowish brown. Second part of the trochanter and base and upper margin of femora black on the inside. Middle and hind femora and tibiæ with three blackish rings.

Length of body 17–18, of pronotum 3·2–3·5, of tegmen 17 mm.

Type. ♂, Sierra Leone, Moyamba, 29. i. 1925 (*E. Hargreaves*).

Paratypes. 1 ♂, Sierra Leone, Mando, 25. v. 1925 (*E. Hargreaves*), and 1 ♂, Sudan.

The species described above is very closely related to *O. annulatus*, Serv., but differs in having rather long and entirely pale spines on the inner margin of the front coxæ, and darker brown spots on the tips of all longitudinal veins of the tegmina and wings.

Oxypilus nigericus, sp. n.

♂. General colour pale brownish yellow. Ocellar tubercles pointed. Appendage of the head with two rounded lobes at the top and two teeth on each side. Collar of the pronotum with four tubercles, shaft with two dorsal and two lateral ones, the margins with long spines. Tegmina rather long, subtransparent, all their veins pale brownish; tip of the tegmina and wings with darker brown dots at the ends of the longitudinal veins; longitudinal veins of the costal field indistinctly speckled with brownish. Front coxæ with rather long and entirely pale spines on the inner margin, and with five black, partly interrupted, longitudinal stripes on the inner side. Front femora with four discoidal and four external spines. Middle and hind legs with three dark brown rings on femur and tibia.

Length of body 24, pronotum 4·5, tegmen 22 mm.

Type. ♂, N. Nigeria, Azare, 1925 (*Dr. Ll. Lloyd*).

Paratype. 1 ♂, same locality.

Allied to *O. strigipennis*, Westw., but differing in the less infuscated and more transparent tegmina, in the veins in these being paler, and in the external spines on the front femora being a little more slender.

Oxyothespis brevipennis, sp. n.

♂. Colour brown. Eyes distinctly conical, with a sharp spine above. Antennæ with long and dense hairs. Pronotum narrow, smooth above, its lateral margins very finely denticulate; shaft of the pronotum with a distinct and smooth median keel. Tegmina short, vitreous, their longitudinal veins with small brown dots; costal field with a brownish longitudinal stripe from the base to the middle. Wings vitreous, their longitudinal veins speckled with brown as in the tegmina. Front coxæ shorter than the shaft of the pronotum. Front femora with four external spines of equal length, and four discoidal spines. Cerci very long and flat, their last joint almost four times as long as broad, truncate at the apex.

Length of body 35, pronotum 8, its shaft 5·8, width of the pronotum 1·1, length of tegmen 14·5, of front coxæ 4, of cerci 5 mm.

Type. ♂, Gold Coast, Makango, 18. vi. 1928 (*A. W. J. Pomeroy*).

Allied to *O. maroccana* (Bol.), but differing in the smaller size of the body, in the shorter pronotum and tegmina, and the finely denticulate lateral margins of the pronotum.

Oxyothespis brevicollis, sp. n.

♂. Colour greenish brown. Eyes conical, with a moderately long and sharp spine. Antennæ rather long and densely hairy. Pronotum relatively short, its lateral margins finely denticulate, its dorsal keel smooth. Tegmina and wings vitreous, with several small black dots on the longitudinal veins. Costal field unicolorous, without black line; discoidal field of the tegmina and anal field of the wings without black spots. Front coxæ as long as the shaft of the pronotum. Femora sparsely granulate, with four marginal external and four discoidal spines. Tibiæ with eight to nine external spines. Cerci very long and flat, their terminal joint pointed, nearly four times as long as broad.

Length of body 37–40, of pronotum 7, shaft of pronotum 5, greatest width of pronotum 1·2–1·3, length of tegmen 18·5–19, front coxæ 4·5, hind femora 9 mm.

Type. ♂, Abyssinia, S.E. of Lake Zwai, circa 5500 feet, 10–13. xi. 1926 (*J. Omer-Cooper*).

Paratype. 1 ♂, same locality.

Differs from all the other African species, especially in the shorter pronotum.

Parasphendale gracilicollis, sp. n.

♂. Olive-coloured. Frontal scutellum with a brownish transverse line on the upper margin. Pronotum rather narrow, its lateral margins quite smooth, collar with several little tubercles on the dorsum. Tegmina vitreous, border between the costal and the discoidal field green. Wings vitreous, their costal field reddish, except the tip, which is yellow. Front coxæ with five large teeth, which are entirely black, and with two to four small ones between; two large and distinct dark cross-bands. The longest marginal internal and the discoidal spines black, also the spine, which is situated before the apical claw of the tibia. Front tarsi black on the inner surface.

Length of body 38, of pronotum 11, of its shaft 8, greatest width of pronotum 2·2, length of tegmen 26, of front coxæ 7 mm.

Type. ♂, British East Africa (Kenya Colony), Lake Baringo, 1907 (*R. Ford*).

Closely allied to *P. costalis*, Kirby, and *P. minor*, Schult., but differing in the lateral margins of the pronotum being entirely smooth and in the shorter tegmina.

NEOCILNIA, gen. nov.

♀. Head transverse, triangular, vertex nearly straight. Frontal scutellum transverse, narrow. Pronotum rather long and narrow, with a distinct supra-coxal dilatation, and with finely denticulate lateral margins. Tegmina opaque, a little longer than the abdomen, their costal field rather narrow. Front coxæ a little longer than the shaft of the pronotum, denticulate on the upper margin, and with fairly long spines on the inner margin. Front femora without dilatation above, their upper margin straight, their inner side with a black spot extending from the base to the claw-furrow. Middle and hind legs long, first tarsal joint of the latter as long as the following tarsal joints.

Differs from *Cilnia* in the straight upper margin of the front femora; from *Paracilnia* in the longer pronotum; from *Taumantis* in the narrow costal field of the tegmina; and from *Miomantis* in the stronger front coxæ and femora, these latter having a single large black spot at the base.

Neocilnia gracilis, sp. n.

♀. Colour green. Frontal scutellum about 2½ times as long as high, its upper margin projecting in the middle and broadly rounded, not angulate. Pronotum a little more than three times as long as wide, its shaft twice as long as the collar, supra-coxal dilatation oval, lateral margins finely denticulate. Tegmina opaque, with parallel veins in the costal field. Wings subopaque. Front legs: coxæ with seven or eight fairly long spines on the inner margin, and with shorter spines between these; hind margin of the coxæ denticulate. Femora with four discoidal and four external spines, and with a large black spot extending from the base to the claw-furrow; the spines blackish only at the tips.

Length of body 26, pronotum 9·5, its shaft 6·5, width of pronotum 3, length of tegmen 16·5, width of the costal field 1, length of the front coxæ 7, of the hind femora 9·5 mm.

Type. ♀, S. Africa, Cape Province, Ceres, iii. 1925 (*R. E. Turner*).

Miomantis natalica, sp. n.

♂. Colour greenish. Frontal scutellum projecting and rounded on the upper margin. Eyes somewhat conical, but not pointed. Pronotum with smooth lateral margins. Tegmina and wings vitreous, anterior margin of the discoidal field of the former green and opaque. Front legs: coxæ with a series of five black dots along the inner margin; trochanter unicolorous; femora with four black dots, of which the distal one is the largest; spines on the femora blackish at the tips only.

Length of body 33, of pronotum 9, shaft of pronotum 6·5, greatest width of pronotum 2, length of tegmen 23, front coxæ 6 mm.

Type. ♂, Natal, Durban, 5. iv. 1894 (*H. W. Whyte*).

The new species differs from *M. semialata*, Sauss., in the upper margin of the frontal scutellum being a little more prominent, and in the front femora being adorned with four spots; from *M. quadripunctata*, Sauss., in having a series of black dots along the inner margin of the front coxæ, and rather a longer pronotum.

Miomantis australis, sp. n.

♂. Colour green. Frontal scutellum transverse, its upper margin projecting and rounded in the middle. Eyes rounded, not conical. Pronotum rather long and thin, its lateral margins smooth. Tegmina transparent, the boundary-line between the costal and discoidal field marked with yellow and green, opaque. Wings transparent. Front legs: coxæ but a little shorter than the shaft of the pronotum, without black dots, and with six or seven small teeth on the inner margin; trochanters without black dots; femora with three black dots, one at the base, one at the first discoidal, and one at the first marginal spine; spines blackish at their tips only.

Length of body 35–38, pronotum 9·5–10, shaft of pronotum 6·8–7, width of pronotum 1·8, length of tegmen 28–30, front coxæ 6·5 mm.

Type. ♂, S.W. Africa, Okahandja, 19–29. iii. 1928 (*R. E. Turner*).

Paratypes. 1 ♂, same locality, 3–11. xii. 1927; 1 ♂, S. Africa, Kimberley, 14. iv. 1920 (collector unknown).

Related to *M. exilis* (G.-Tos), but differing in having a longer pronotum and longer tegmina, and to *M. aurantiaca* (G.-Tos), but without the black dot on the trochanter.

Miomantis feminina, sp. n.

♀. Colour greenish. Frontal scutellum transverse, projecting and rounded in the middle of the upper margin. Eyes conical, but not pointed. Pronotum rather long and narrow, smooth above, distinctly denticulate on its lateral margins. Tegmina green, opaque, much longer than the pronotum, tapering nearly to a point at the tip. Wings vitreous, except their tips, which are green and opaque. Front legs: coxæ with a series of seven black dots along the inner margin; trochanters unicolorous; femora with two black dots, one at the base of the first discoidal spine, the other at the first marginal spine; all the spines blackish at their tips only.

Length of body 34, pronotum 9·5, shaft of pronotum 6·5, width of pronotum 2·5, length of tegmen 17, front coxæ 8 mm.

Type. ♀, Abyssinia, Abbai Affat, v., vi. 1902 (*Degen*).

Allied to *M. longicollis*, Sauss., but distinguishable by the different size of the body and the presence of two black dots on the front femora.

Plistospilota nova, sp. n.

♀. Body large and robust, brownish. Frontal scutellum transverse, rounded above. Pronotum large, its lateral margins finely denticulate. Tegmina entirely green on the costal field, and without black spots on the under side of the latter. Discoidal field brownish, with indistinct darker brown spots, especially on the under side. Costal and discoidal field of the wings with six dark brown transverse spots, the anal field infuscated, transparently spotted. Front legs: coxæ entirely yellowish brown; their inner margin with eleven to twelve short teeth. Femora with a black spot between the base and the claw-furrow, and another at the base of the first internal spine. Discoidal and large internal marginal spines entirely black. Tibiæ with nine to ten external spines.

Length of body 94, pronotum 36·5, its shaft 29, greatest width of pronotum 9, length of tegmen 65, front coxæ 8 mm.

Type. ♀, India, Cachar, 18. x. (*W. Grant*).

This large species is readily recognizable by its pronotum, by the entirely green costal field of the tegmen, and by the black spot between the base and the claw-furrow of the front femora.

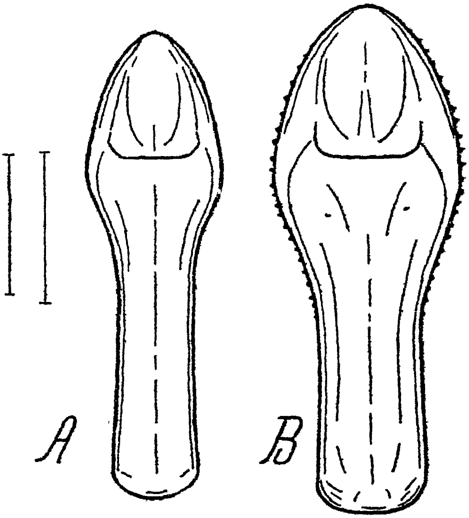
Sphodromantis gracilicollis, sp. n. (Fig. 3.)

♂ ♀. Colour green. Frontal scutellum somewhat broader than high, with two distinct longitudinal keels. Pronotum very narrow for the genus, its supra-coxal dilatation oval and gradually tapering behind, its shaft very narrow, its lateral margins denticulate in the female, smooth in the male. Tegmina rather broad and as long as the abdomen in the female, narrower and longer than the abdomen in the male; the female has the costal field nearly half as broad as the discoidal field and its tegmina are entirely opaque, the stigma reddish; the tegmina of the male are transparent in the discoidal field, the anterior margin excepted, and the stigma is yellowish. Front legs: coxæ with three or four spines thickened at the base, without greater white callous areas on the internal surface; front margin between the teeth smooth in the male, with a number of shorter spines in the female.

The three basal discoidal spines entirely black; the internal surface entirely green (in a single male with a blackish spot on the distal side of the claw-furrow).

Length of body, ♂ 55–61, ♀ 65, pronotum, ♂ 17·5–18·5, ♀ 20·5, its shaft, ♂ 13–14, ♀ 14·5, width of pronotum, ♂ 4·8–5·5, ♀ 7, tegmen, ♂ 43–47, ♀ 39, width of the costal field in the ♀ 4 mm.

Fig. 3.



Sphodromantis gracilicollis, sp. n., pronotum: A, of the male; B, of the female.

Types. ♂ ♀, Gold Coast, Bibianaha, ix.–xii. 1909 (*Dr. Spurrell*).

Paratypes. 4 ♂ ♂, same locality and collector.

Allied to *S. lineola* (Burm.), but differing from this and the other species in the very narrow pronotum, especially in the narrowness of its shaft.

Ischnomantis gigas (Sauss.)?.

Brunneria gigas, Saussure, Mitt. Schweiz. Ent. Ges. iii. p. 240, (1870), ♂.

The collection of the British Museum contains a very large female of *Ischnomantis*, which I take to represent the undescribed female of *I. gigas* (Sauss.). Its description is as follows:—

Frontal scutellum very narrow, truncate on the upper margin. Pronotum long, its lateral margins toothed;

median keel of the shaft distinct. Tegmina short, opaque, with two indistinct blackish transverse spots. Wings blackish, their tips paler. Front coxæ with ten to eleven teeth on the inner margin. Discoidal spines on the front femora yellowish, their tips only black. Acetabular spine fairly long, yellowish. Supra-anal plate very long, pointed, but a little shorter than the front coxæ.

Length of the body 126, pronotum 43, its shaft 33, width of pronotum 7, length of tegmen 19, fore coxæ 24, supra-anal plate 21 mm.

W. Kordofan, Agageh Wells, 14. xi. 1902 (*Captain H. N. Dunn*).

Ischnomantis gracilis, G.-Tos.

Ischnomantis gracilis, Giglio-Tos, Bull. Soc. Ent. Ital. xlvii. p. 29 (1916), ♂.

The collection before me includes two females from Kenya Colony, Mbuyuni (*C. S. Betton*), which I take to belong to *I. gracilis*, G.-Tos, because the frontal scutellum is rounded on the upper margin, not truncate as in *I. æthiopica*. Acetabular spine yellowish. Wings lighter at the base, with a yellow spot near their tips. Tibiæ entirely yellowish. All the spines of the front legs blackish on the tips only.

Length of body 85–87, pronotum 27–29, its shaft 20·5–22, tegmen 14, supra-anal plate 13 mm.

Parablepharis kuhlii (Haan).

Mantis (*Blepharis*) *kuhlii*, Haan, Verh. nat. Gesch. Nederl. Bezitt. Ins. p. 93, t. xviii. fig. 3 (1842).

A female of this remarkable species from Tonkin, Than-Moi (*H. Fruhstorfer*), is very large.

Length of body 73, of pronotum 24, its width 20, length of tegmen 34 mm.

In all the other characters the specimen agrees with the species cited.

Acromantis grandis, sp. n.

♀. Colour brownish except the costal field of the tegmina, which is green. Frontal scutellum with its upper margin triangularly projecting and pointed. Vertex with a distinct conical and pointed tubercle above the ocelli. Eyes rounded. Pronotum smooth above, its lateral margins bearing small but distinct black teeth. Tegmina and wings brownish, sub-opaque, the former with a green and opaque costal field, and a densely reticulate discoidal field. Coxæ with distinct teeth on the inner margin. The larger internal spines on the femora entirely black. Middle and hind legs as usual in the genus.

Length of body 41, pronotum 11·5, its shaft 8, greatest width of pronotum 4·5, length of tegmen 28 mm.

Type. ♀, Tonkin, Than-Moi (*H. Fruhstorfer*).

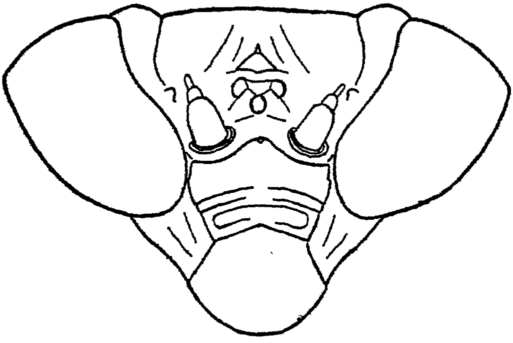
Allied to *A. japonica*, Westw., but differing in having a distinct conical and pointed tubercle above the ocelli and in the body being larger; the body is, in fact, much larger than in any other species of the genus.

METACROMANTIS, gen. nov.

♀. Shape as in *Acromantis* and *Deiroharpax*. Frontal scutellum triangularly projecting, with its upper margin pointed. Vertex with a sharp conical tubercle immediately above the ocelli. Eyes distinctly conical. Pronotum long, smooth above, its lateral margins denticulate. Tegmina transparent except the costal field. Front coxæ denticulate on the inner margin. Femora not enlarged, but distinctly concave on the upper margin, with four discoidal and four external spines. Tibiæ with external spines close together. Middle and hind femora lobate basally and distally.

The new genus is distinguishable from *Acromantis* by its conical eyes and by the concave upper margin of the front femora; from *Deiroharpax* it may be distinguished by the conical eyes.

Fig. 4.



Metacromantis oxyops, gen. et sp. n., ♂, head.

Metacromantis oxyops, sp. n. (Fig. 4.)

♀. General colour brown. The conical pointed tubercle above the ocelli distinct. Eyes distinctly conical, but not pointed. Lateral margins of the pronotum bearing small black teeth. Tegmina transparent, except the costal field, which is green and opaque; discoidal field with a brown spot near the stigma and a brown cross-band, not reaching the hind margin, before the middle. Wings transparent, infuscated at their tips. Front legs: coxæ with six blackish teeth on the inner margin, granulate outside, blackish at the tip. Femora concave on the upper margin, outside spotted with blackish. Hind legs with brown rings; middle femora with distinct lobes at base and tip; basal lobe of the hind femora indistinct.

Length of body 35, pronotum 12, its shaft 8·5, width of pronotum 3, length of tegmen 25, of front coxæ 8 mm.

Type. ♀, Ceylon, Haragama, 18. vii. 1910 (*E. E. Green*).

Galinthias occidentalis, sp. n.

♀. General colour green. Head black on the frontal and occipital region, with three green longitudinal spots, the inner side of the upper half of the eye-cones triangularly black. Eyes very prominent, each with a small ocular spine. Antennæ entirely black, except the basal part, which is green. Pronotum long and narrow, its supra-coxal dilatation distinct. Two short stripes on the pronotum, running backwards from the anterior margin. Lateral margins of the pronotum very finely denticulate. Tegmina opaque green, their costal field in the anterior part with a longitudinal, yellow, opaque stripe. Wings red, the tip of the costal and the discoidal field green, distal part of the anal field brown. Front coxæ unarmed. Front femora unicolorous, without black spot on the inner side. Middle and hind femora distally lobate, tibiæ with two indistinct lobes on the outer side.

Length of body 28, pronotum 10, its shaft 7·5, length of tegmen 16, front coxæ 6·5 mm.

Type. ♀, Sierra Leone, Njaba, xii. 1926 (*E. Hargreaves*).

The species described above is readily distinguishable from the closely allied *G. amœna* (Sauss.) by the different colour of the head and antennæ, and by the front femora being unicolorous.

UVAROMANTIS, gen. nov.

♂. Frontal scutellum transverse, with a triangular projection in the middle of its upper margin. Vertex with a very short appendage above the ocelli, bearing two small points, and with a short tubercle on each side. The tubercle near the eyes strong and conical. Eyes conical, almost heart-shaped. Collar of pronotum with four strong but nearly connate tubercles ; shaft of the pronotum with two strong median tubercles and four small lateral ones. Tegmina and wings long. Front femora enlarged, with four discoidal and four external spines. External spines on the tibiæ close together. Middle and hind legs somewhat lobate. Supra-anal plate transverse, rounded. Subgenital plate nearly truncate at its tip. Cerci cylindrical, as long as the subgenital plate.

This genus belongs to the *Otomantis* group, but differs from *Otomantis* itself in the shape of the pronotum, and from *Chrysomantis* in the conical eyes and the short appendage on the vertex.

Uvaromantis tristis, sp. n.

♂. General colour of the body dark brown. Frontal scutellum with three flat longitudinal keels and the angle of the triangularly projecting upper margin obtuse. Appendage on the vertex very short, divided at the tip. Tubercles between the furrow of the vertex and the eyes conical. Eyes nearly heart-shaped. Antennæ brownish, but yellowish above at the base. Pronotum with a deep supra-coxal furrow, its collar and shaft with high median tubercles, its lateral margins bearing small black teeth. Tegmina brown and subopaque in the basal halves, transparent, with brown and ferruginous spots, in the distal halves, and with a distinct blackish brown cross-band behind the stigma ; costal field dark brown, opaque. Wings transparent, except the costal field and the tips, which are dark brown, and their bases, which are infuscated. Front coxæ brownish, their inner margins very finely denticulate. Femora blackish inside, granulate in the median line outside, with four external and four discoidal spines ; spines on the inner margin entirely black. Middle and hind femora with a triangular lobe before their tips ; tibiæ indistinctly lobate on the outside.

Length of body 27, pronotum 5, width of pronotum 3, length of its shaft 3, of tegmen 20, front coxæ 6 mm.

Type. ♂, Gold Coast, Makango, 18. vi. 1928 (*A. W. J. Pomeroy*).

Pseudoharpax abyssinicus, sp. n.

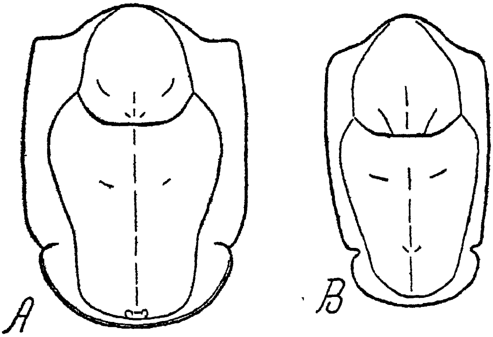
♂. General colour green. Ocular spines strong, distinctly curved outward. First two joints of the antennæ yellow, the following twelve joints black and the rest reddish brown. Pronotum oval, about 1·6 times as long as broad, its lateral margins insensibly passing into the anterior margin, the latter slightly projecting ; shaft of the pronotum with two oblong black spots behind. Tegmina vitreous, their veins green. Wings vitreous, basally roseate. Front coxæ unarmed, but bearing several small bristles. Middle and hind femora strongly lobate distally, tibiæ indistinctly lobate.

Length of body 26, pronotum 4, greatest width of pronotum 2·5, length of tegmen 19, front femora 4·5 mm.

Type. ♂, Abyssinia, Plains N. of Lake Zwai, 5500–6000 feet, 3–4. xi. 1926 (*Dr. H. Scott*).

This species is somewhat closely allied to *Ps. erythræus*, G.-Tos, from which it differs in having a narrower pronotum and a little shorter tegmen.

Fig. 5.



A. *Pseudoharpax laticollis*, sp. n., ♀.
B. *Pseudoharpax ugandanus*, G.-Tos, ♀, pronotum.

Pseudoharpax laticollis, sp. n. (Fig. 5, A.)

♀. Colour green. Body rather robust. Eyes with short blunt spines. Ocelli small, with pointed ocellar tubercles. Pronotum very broad, lamellate, only a little longer than broad, its anterior angles rounded right angles, its lateral margins parallel. Tegmina as long as the abdomen, rather narrow. Wings for the greater part of their extent from the base, as also in the discoidal field, roseate, distally only vitreous, in the anal field with a narrow brown band between the roseate and vitreous areas. Abdomen dorsally with two series of lateral black spots. Front coxæ almost unarmed ; femora with four external and four discoidal spines. Tibiæ with nine external and twelve internal spines. Middle and hind femora distally strongly lobate, tibiæ with two indistinct lobes.

Length of body 26, pronotum 5, width of pronotum 4, length of its shaft 2·2, length of tegmen 18, greatest width of tegmen 5·5, length of front coxæ 5·5 mm.

Type. ♀, Mashonaland, Salisbury, xi. 1899 (*G. A. K. Marshall*).

Allied to *Ps. ugandanus*, G.-Tos (fig. 5, B), but differing in the extraordinarily broad pronotum, a feature which is not exhibited by any of its congeners.

Calamothespis adusta, Wern.

Calamothespis adusta, Werner, SB. K. Akad. Wiss. Wien, math.-naturw. Cl. cxvi. p. 237, t. i. fig. 6 (1907).

The British Museum possesses an adult male of this rare and interesting species from Mashonaland, Umtali, 1900 (*G. A. K. Marshall*). The eyes of this individual bear a short and weak, but distinct spine on the outside, as in Werner's type (which is from Mongalla), although Werner omits to mention it in his original description, and Giglio-Tos makes no reference to it in his description of the adult female. The ocular spine therefore exists not only in *C. oxyops*, Rehn, as Rehn believes, but is a generic character.

The measurements of this specimen are:—Length of body 75, pronotum 22, its shaft 17, width of pronotum 3, length of tegmen 38, front coxæ 10, front femora 13, front tibiæ 9, hind femora 7, hind tibiæ 6·5, cerci 3·5 mm.

Hagiotata hofmanni, Sauss. & Zehnt.

Hagiotata hofmanni, Saussure & Zehnter, Biol. Centr.-Amer., Orth. i. p. 197 (1894), ♀.

Of this rare and interesting species the female alone is as yet described. In the British Museum collection there is a male from Argentina, Villa Ana, F.C.S.F., i. 1924 (*K. J. Hayward*), which I regard as belonging to *H. hofmanni*. This specimen is very similar to the female in size, but has transparent, not green, tegmina. The ocellar tubercles are short and pointed, but not black at the tips. Antennæ brownish, serrate above. Pronotum long, its shaft carinate and bearing small black tubercles, its lateral margins with fairly long black spines. The tegmina are vitreous, adorned with several small chocolate-brown spots, and a similarly coloured cross-band behind the stigma; a larger spot before the stigma and before the tip, and the tip of the tegmen itself also brownish. The wings are similar in colour to the tegmina. Middle and hind tibiæ indistinctly lobate.

Length of body 62, of pronotum 21, shaft of pronotum 16·5, length of tegmen 37 mm.

Pseudovates bidens (F.).

This species, which is known to occur in Brazil, is represented in the collection before me by a male from Jamaica, Mandeville, 1924-98 (*L. J. Bertram*).

Popa undata (F.).

A male and female from Kenya Colony, the former from Eb Urru, iv.–v. 1900 (*C. S. Betton*), the latter from Kabete, iii. 1922 (*H. E. Box*), belong to this somewhat rare species. The specimens are remarkable on account of their relatively short pronotum.

Length of body, ♂ 45, ♀ 43, pronotum, ♂ 10, ♀ 13, its shaft, ♂ 7, ♀ 9, width of pronotum, ♂ 3·5, ♀ 5, length of tegmen, ♂ 35, ♀ 15, front coxæ, ♂ 7, ♀ 9 mm.

Blepharodes parumspinosus, sp. n.

♂ ♀. Colour green or brown. Appendage of the head long in the female, shorter in the male, and divided at the tip. Pronotum as usual in the genus. Tegmina subopaque, slightly spotted with green or brown. Front coxæ less curved behind than in *B. cornutus*, and bearing stronger spines. Front femora with a black spot extending from the claw-furrow to the third large marginal spine. Tibiæ with only ten external spines.

Length of body, ♂ 30–33, ♀ 44–50, pronotum, ♂ 7–8, ♀ 12–13, its width, ♂ 3·5–4, ♀ 7–8, length of tegmen, ♂ 25–30, ♀ 24–27, front coxæ, ♂ 6–7, ♀ 11–12 mm.

Types. ♂ ♀, N. Nigeria, Azare, 1925, 1926 (*Dr. Ll. Lloyd*).

Paratypes. 1 ♂, same locality and collector, vii. 1924; 1 ♀, Sudan, Bara, x. 1927 (*W. P. L. Cameron*).

Closely related to, and perhaps only a subspecies of, *B. cornutus* (Schult.-Rechb.); differing in having only ten external spines on the front tibiæ, the hind margin of the front coxæ less curved and more strongly spinose, and the tegmina of the female a little longer.

The genus *Phlæbarodes*, G.-Tos (1917), is identical with *Blepharodes*, Bol. (1891), the front coxæ in all the known species—*B. cornutus* (Schult.-Rechb.), *B. candelarius*, Bol., *B. sudanensis*, Wern., and *B. parumspinosus*, Beier—being nearly as long as, or a little shorter than, the pronotum.

XLIX.—*Entomological Expedition to Abyssinia*, 1926–27; *Trichoptera and Ephemeroptera.* By Dr. Georg Ulmer (Hamburg) *.

Hitherto only two species of Trichoptera and no Ephemeroptera were known to occur in Abyssinia. The material kindly sent me for determination enables us to enumerate 8 species of Trichoptera and 4 of Ephemeroptera—still, surely, a meagre enough list. It was all obtained in the high lands of Central Abyssinia by Dr. Hugh Scott and Mr. J. Omer-Cooper during their expedition, between September 1926 and January 1927, both inclusive. In the present case, almost all the adults of both Orders, and the larvæ of Trichoptera, were collected by Scott, but the numerous nymphs of Ephemeroptera practically all by Omer-Cooper. A first set of specimens, including the types of the new species, is in the British Museum, but I am indebted to the collectors for permission to keep duplicates for my own collection.

I. TRICHOPTERA.

1. *Chimarrha abyssinica*, Banks, Trans. Amer. Ent. Soc. xxxix. p. 235 (1913). (Figs. 1–3.)

The type of this species is a ♀. The collection now under review includes a ♂, which can be described as follows:—Head, pronotum, and hind part of the mesonotum golden-yellow, similarly haired; rest of the mesonotum and the whole metanotum, together with the under surface of the thorax, black; a quadrangular black mark on the head between the ocelli, touching the ocelli with three of its corners, while the fourth lies in the middle line directed straight backwards; antennæ blackish brown, about the first five segments yellow, the following segments (about eight) ringed with yellow and brown, the dark part becoming progressively more extensive till the greater part of the antenna appears unicolorous dark; palpi blackish brown, the two first segments and base of the third segment of the maxillary palpi yellow; segment i. very short, ii. long, iii. still longer, iv. shorter than ii., v. about as long as ii. Abdomen dark golden-yellow or ochreous-yellow with a faint reddish tone. Legs yellow, but the coxæ and bases of the femora, also the tarsal segments (excepting the basal part of segment i.), and finally the spurs, are blackish brown; the claws of the front tarsi are fairly large; spur-formula 1, 4, 4.

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* Translated by Hugh Scott from the original German.

Wings with dark grey membrane and thick brownish-black, or almost black, hairs ; fore wings with a large, silver-white-haired round mark over the discoidal and median cells, a silver-white-haired longitudinal stripe at the base of the costal ramus, and a similar, rather wider, longitudinal stripe in the cubito-anal region, also at the base of the wing; the arculus whitish; marginal fringe and veins of both wings brownish black, the veins more prominent in the hind wing, which is more translucent, than in the fore wing. Nervature (see fig. 1): in the front wing the lower border of the discoidal

Fig. 1.

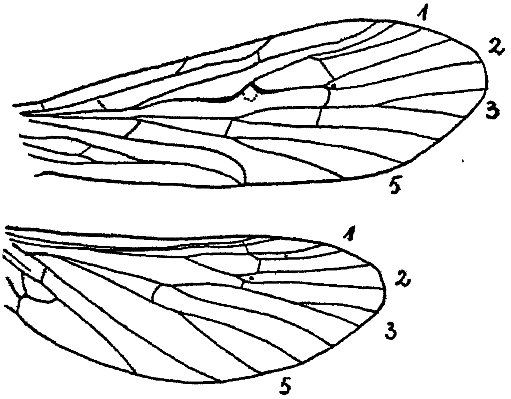
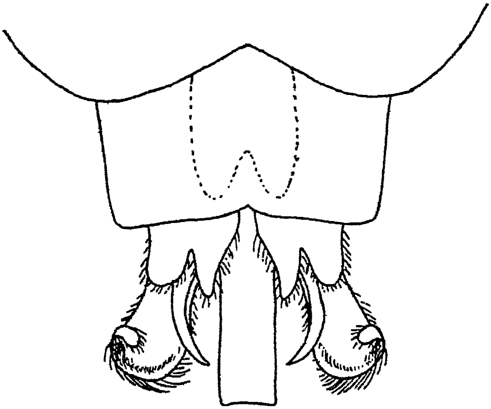


Fig. 2.

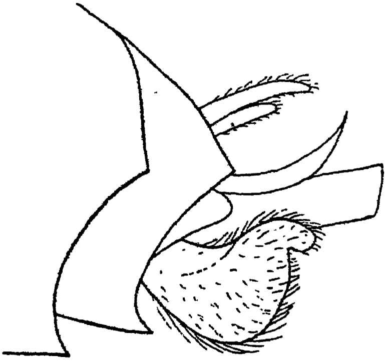


Chimarrha abyssinica ♂.

Fig. 1.—Wings.
Fig. 2.—Genital appendages, dorsal view.

cell is strongly convex and thickened, so that the cell is wide in that part; the pedicel of the discoidal cell is strongly curved and also thickened at the bend; "naked cell" clear; the cross-veins of the anastomosis form an arch with the convexity outwards; the median and the thyridium cells are about equally long, a little longer than the discoidal cell; apical forks, excepting those of 3 and 5, sessile in both wings. Genital appendages of the ♂ (figs. 2, 3) brownish grey; in dorsal view a bipartite plate is visible on either side above, the inner division of which is longer and more slender than the outer; the two parts of each plate are separated by a narrow cleft; beneath each plate protrudes a strong inward (and upward) curved chitinous hook, about double as long as the plate; in the median plane lies a long, cylindrical body, truncated at the apex, probably the penis; the "genital feet" are ear-shaped, hollowed out on the inner surface, with the posterior lateral angles bent over the surface as a little process. In lateral view both parts of each dorsal plate appear as slender processes lying one above the other, the upper longer than the lower; the strongly chitinized hooks are bent upwards; the "genital feet" are ear-shaped plates, deeply hollowed on the inner surface, convex on the outer, prolonged at the upper apical angle into a blunt process; this outline of the latter continues, after an emargination, into the convex apical margin. The last two sternites, and especially the last of all, are strongly and sharply produced in the middle of the hind margin (see fig. 3).

Fig. 3.



Chimarrha abyssinica ♂; genital appendages, lateral view.

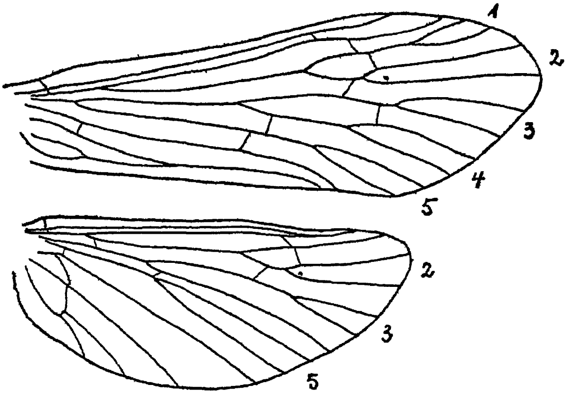
Length of body 5 mm.; of fore wing 7 mm., expanse of wings about 15 mm. (in the ♀, according to Banks, 17 mm.).

Loc. Mulu, above the Muger Valley, ca. 8000 feet, from mountain-streams, 19–21. xii. 1926, 1 ♂ (*Scott*).

2. *Hydropsychodes falcifera*, sp. n. (Figs. 4–7.)

Head brownish black, thorax blackish brown, metanotum dark brown, abdomen dark yellowish brown, often reddish brown above and brownish yellow below; under surface of head and thorax also lighter, generally yellowish brown. Hairs clothing the head and thorax bright yellow. Antennæ in the basal third of their length brownish yellow with distinct blackish-brown rings at the points of articulation, which rings widen progressively distally; remainder of the antennæ unicolorous blackish brown. Palpi greyish brown, segment i. of maxillary palpi very short, the following segments rather long, iii. and iv. about equally long, ii. somewhat longer, v. as long as the others together. Legs yellowish, washed over with greyish brown, the hind tibiæ whitish yellow; spur-formula 2, 4, 4, the outer spur of the front tibia very short. Wings with very clear membrane, almost colourless to faintly grey; front wings with bright golden hairs, and marbled between them with dark brown points, which are usually arranged in numerous transverse series, some of which are confluent, especially on the cross-veins; veins brown, fairly distinct; marginal fringe dark greyish brown; hind wings rather broader than the fore

Fig. 4.



Hydropsychodes falcifera ♂; wings.

wings, appearing lighter, strongly iridescent, with more scattered, light dull golden to whitish-golden hairs, with clearly marked brown veins and with whitish-grey to whitish-brown marginal fringe. Nervature (see fig. 4). The

Fig. 5.

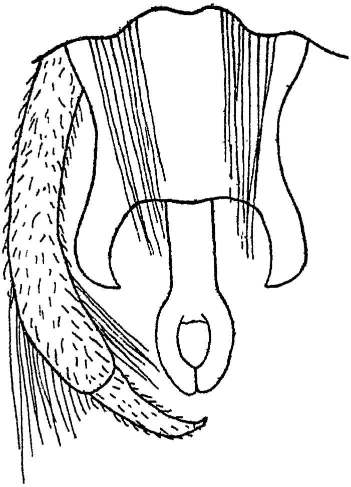
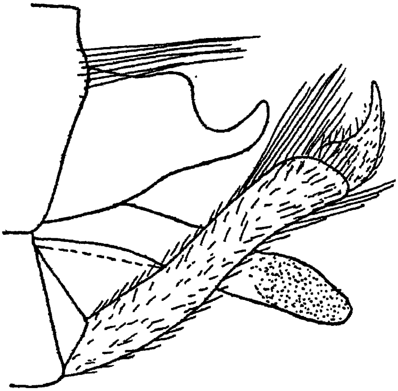


Fig. 6.

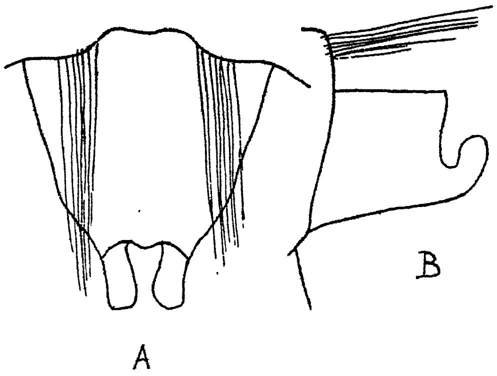


Hydropsychodes falcifera ♂.

Fig. 5.—Genital appendages, dorsal view.
Fig. 6.—Genital appendages, lateral view.

genital appendages of the ♂ (figs. 5, 6) are brownish yellow, with the second segment of the "genital feet" brown; the hind margin of the ninth tergite shows three prominences, of which the two lateral are set with long bristle-hairs; tenth tergite large and broad, hollowed out on its ventral surface; in dorsal view its side-margins are concave, the posterior lateral angles are produced into long sickle-shaped processes with sharp inwardly directed apex; the intervening space is nearly semicircular, but with base nearly straight and slightly produced in the middle; in lateral view the breadth of the tenth tergite diminishes a little towards the apex, its dorsal margin is feebly concave, its ventral margin sinuate like a flattened S, the process slightly bent upwards and pointed, the steep slope from the dorsal margin to the process is almost perpendicular, with the upper angle rounded off; the penis is broadened and cleft at the apex, and the cleft extends into a space with nearly ovate outline; the "genital feet" are strong, their first segment is curved and set with long hairs at the apex, the second segment, seen from above, is slender, but, viewed from the side, its base is broad, while more distally the dorsal margin is strongly concave and the apex is bluntly pointed.

Fig. 7.



Hydropsychodes falcifera ♂, var.; tenth tergite.
A, dorsal, B, lateral view.

Length of body 4–5 mm.; of fore wing 6–7½ mm.; expanse of wings about 13–16 mm.

Loc. Ravine of the Akaki River, S.E. of Addis Ababa, 6500–7000 feet, at light in tent, 17. x. 1926, 3 ♂, 2 ♀ (*Scott*); Muger Valley, ca. 5500 feet, 28–29. xii. 1926, 2 ♂, 5 ♀ (*Scott*); Hawash Railway Station, ca. 3500 feet, at light, 2. ix. 1926, 1 ♂ (*Omer-Cooper*).

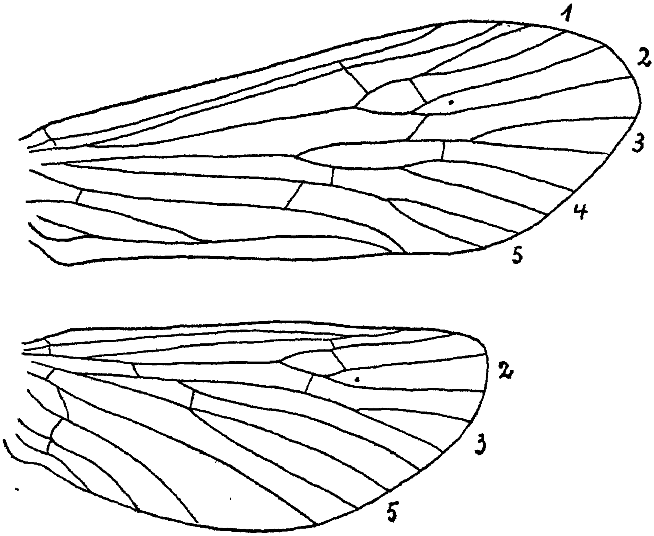
The two ♂ from the Muger Valley have the wings somewhat lighter than the three from the Akaki Ravine, which include the type.

There is yet another ♂ from the Muger River (27. xii. 1926) which resembles the two from the Akaki Ravine, though it perhaps exceeds them a little in the dark marbling of the fore wings ; but its tenth tergite looks different, the terminal processses being (probably through desiccation) drawn under the hind margin and approximated one to the other behind the middle ; thus they appear shorter and, because they are more strongly bent upwards, also blunter (fig. 7, A, B) ; the steep slope down from the body of the tergite to the processes is perpendicular, and forms an angle with the dorsal margin, and the space between the bent-up process and the perpendicular hind face of the tergite is narrow. I do not think, however, that this example represents another species. A good idea of the form of the tenth tergite can be got if one's two hands are held with the ends of the curved fingers together and the thumbs spread apart; by narrowing the space between the hands, curving the thumbs, etc., a mental picture can be formed of both the typical and the varietal form.

3. *Hydropsychodes obscurata*, sp. n. (Figs. 8–10.)

Head and thorax black above, the big convexities of the head and pronotum yellowish brown ; hairs, together with those on the shoulders of the mesothorax, golden-yellow in the type, brownish black in the second example ; antennæ (broken) dark brown to blackish brown, with scarcely lighter rings at the points of articulation ; basal segment lighter brown. Palpi blackish brown ; segment i. of maxillary palpi short, ii. long, iii. and iv. equal and somewhat shorter than ii., v. about as long as the others together. Legs brown, coxæ and tarsi darker, hind femora and tibiæ yellow ; spurs dark brown, claws distinct, those of each pair equal. Wing-membrane dark grey ; fore wings very closely covered with brownish black to almost black hairs and with numerous golden-yellow hair-punctures, which are specially evident in the apical half of the wing, while some stand isolated round the apical margin ; marginal fringe brownish black, veins strong, blackish brown, but much hidden by the hairs ; hind wings appearing rather lighter than the fore wings, covered with unicolorous dark brown to blackish-brown hairs, with marginal fringe and veins alike blackish brown. Nervature (fig. 8) regular, discoidal cell of the fore wing about half as long as the median cell, in the hind wing still smaller; median cell not closed in the hind wing; fork 1 in the fore wing exceptionally long, its pedicel very short, even shorter than that of fork 3. Genital appendages of ♂ (figs. 9, 10) dark greyish brown; ninth tergite forming a semicircular plate, with its hind margin slightly emarginate in the middle and set round with long strong bristles; the tenth tergite lies much deeper than the ninth, is somewhat narrower and longer, and forms a hollow body, feebly keeled in the middle line dorsally and strongly hollowed out beneath; in dorsal view it narrows towards the apex, the middle of its hind margin is slightly produced, and the posterior lateral angles are drawn out each into a long, stout, inwardly curved process; these two processes are narrower at the base and at the bluntly rounded apex than in the middle of their length, and their apices are very closely approximated; in lateral view the dorsal edge of the tenth tergite falls away very steeply, the produced middle part of the hind margin looks like a bluntly triangular prominence, beneath which (but separated from it by a concavity with rounded outline) protrudes the long process, directed almost

Fig. 8.



Hydropsychodes obscurata ♂; wings.

Fig. 9.

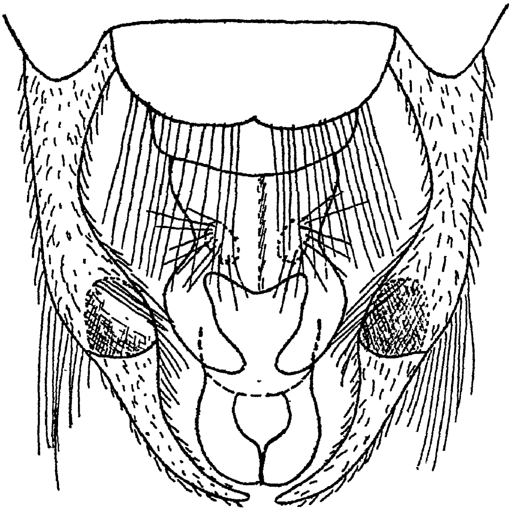
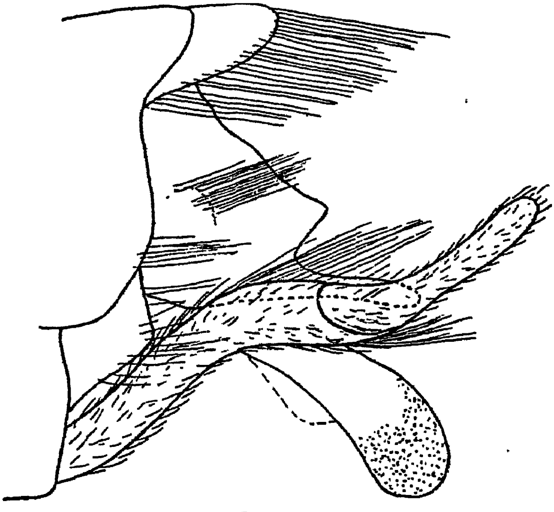


Fig. 10.



Hydropsychodes obscurata ♂.

Fig. 9.—Genital appendages, dorsal view.
Fig. 10.—Genital appendages, lateral view.

straight backwards; on the lateral surface lies on either side (and also visible in dorsal view) a large wart-like elevation set with hairs; penis in dorsal view somewhat broadened at the apex, cleft, with the two terminal pieces somewhat thickened towards the apex and so bent that they touch at their ends, while a nearly circular space is left nearer the base: in lateral view the penis is broadened on the underside before its rounded apex; "genital feet" stoutly built, bent in the form of a flattened S, with the terminal segment about two-thirds as long as the basal; basal segment rather thickened towards the apex, terminal segment narrowed towards the apex and deeply concave dorsally at the base.

Length of body 6 mm.; of fore wing 9 mm.; expanse of wings about 19 mm.

Loc. Holota, near Addis Alam, ca. 8000 feet, from the face of the waterfall just below the bridge, 12. x. 1926, 2 ♂ (*Scott*).

4. *Hydropsychodes plutonis* (Banks). (Figs. 11–14.)

Symphitopsyche plutonis, Banks, Trans. Amer. Ent. Soc. xxxix. p. 239, pl. xxiii. figs. 2, 4, 5 (1913).

This species, of which Mr. N. Banks had already (in 1913) sent me two typical examples, a ♂ and a ♀, does not belong to the genus *Symphitopsyche*, Ulmer; Banks had written in his description: "in hind-wing the radial sector may be connected to median, but the vein here is very indistinct." Precisely the feature characteristic of *Symphitopsyche*, namely, the anastomosis of media and cubitus *, is lacking, as I convinced myself, in both the examples submitted to me; they have quite normal sector radii, media and cubitus, thus three longitudinal veins, while *Symphitopsyche* only possesses two. Therefore the species is a *Hydropsychodes*. Moreover, in the fore wing the subcosta seems to run its course normally, and is not joined to the radius before its apex. I give here figures of the nervature (fig. 11) and genital appendages (figs. 12, 13), to amplify the figures given by Banks. In dorsal view the hind margin of the ninth tergite is concave in the middle, produced and set with long outstanding hairs on either side; tenth tergite broad, somewhat narrowed towards the apex, and divided into two lateral terminal parts by a sharp-angled emargination; these terminal pieces are stoutly built, directed straight backwards, and rounded at the apex; on the surface at about $\frac{1}{3}$

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* I find there is a short cross-vein between sector and media in many examples of *Hydropsychodes* spp. (*cf.* figs. 4, 8, 11) and also in *Hydropsyche*. It may be of even wider occurrence.

the length from the base rises a pad-like transverse elevation, set with long hairs; penis very stoutly built, widened and cleft at the apex, the cleft leading into an almost circular

Fig. 11.

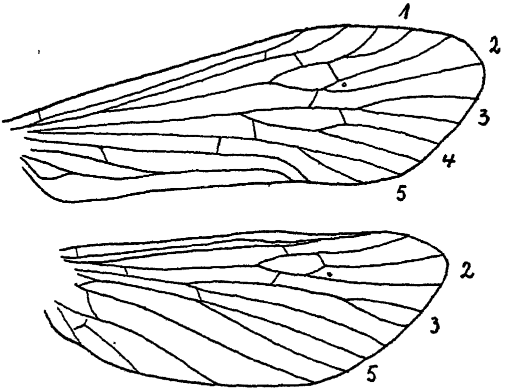
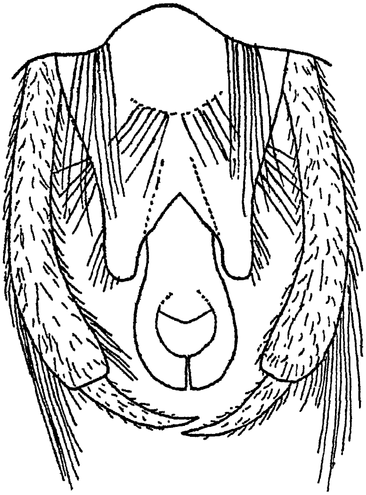


Fig. 12.



Hydropsychodes plutonis ♂ (typical example).

Fig. 11.—Wings.
Fig. 12.—Genital appendages, dorsal view.

space; "genital feet" with a stout basal segment, which is feebly clavate distally, and a slender, sharp-pointed, terminal segment. In lateral view (fig. 13, and compare Banks's fig. 2) the tenth tergite is somewhat bluntly conical, but the dorsal edge is a little sloped off and towards the base has a blunt prominence set with hairs (*i. e.*, the transverse pad seen in side-view); ventral edge feebly concave; penis thick and rounded at the end. The last tergite of the

Fig. 13.

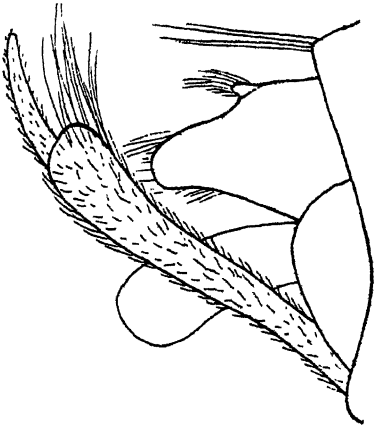
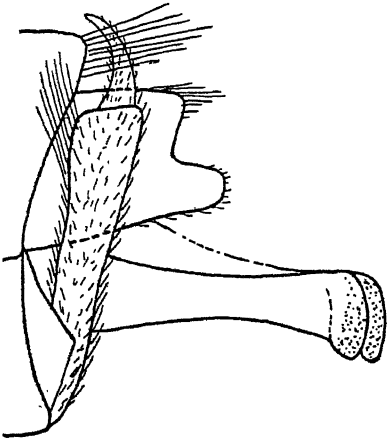


Fig. 14.



Hydropsychodes plutonis ♂.

Fig. 13.—Typical example; genital appendages, lateral view.
Fig. 14.—Example from Wachacha Ravine; genital appendages, lateral view.

♀, which Banks (in his fig. 5) represents as furnished with a long bristle at either hind angle, also bears some other shorter bristle-hairs on its hind margin.

Length of body 4½ mm. (♂)–5 mm. (♀); of fore wing 6 mm. (♂)–7 mm. (♀); expanse of wings about 13–15 mm.

The above remarks refer to the examples received from Mr. Banks. The present Abyssinian collection includes two ♂, one of which has lost the abdomen, which I prefer to place under this species, although the genital appendages in the intact example have quite a different form (fig. 14). The two examples are dark, with nervature normal for *Hydropsychodes*. The wings are rather rubbed, but dark hairs and a faint golden-yellow hair-spot pattern is recognizable on the fore wing, just as in the typical form. The "genital feet" are turned abruptly upwards at the margin of the last segment, and thus conceal the tenth tergite; this latter shows in lateral view an abrupt drop in its outline behind, so that the two terminal lateral pieces are separated from the broad basal part of the segment by a deep, nearly right-angled, emargination; the penis protrudes greatly and is strongly widened towards its base; its apex is bent down, so that the cleft portion lies transversely to the long axis. The dorsal aspect is hard to make out; the two lateral terminal pieces of the tenth tergite appear to lie nearer one to the other, and to be parallel and separated by a straight, not a sharp-angled, emargination. The size of these examples is that of the type.

Loc. Ravine at Wachacha, S.W. of Addis Ababa, ca. 8000 feet, 9. ix. 1926, 1 ♂ (the figured example, *Scott*); ravine of the Akaki River, S.E. of Addis Ababa, 6500–7000 feet, at candle-light in tent, 17. x. 1926, 1 ♂ (*Scott*).

5. *Hydropsychodes bimaculata*, sp. n. (Fig. 15.)

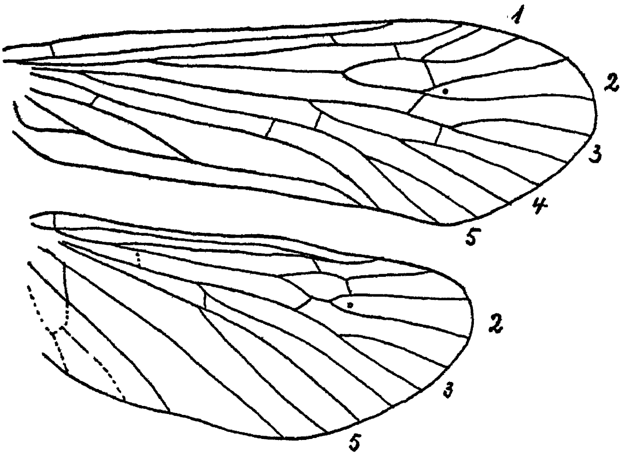
This form is represented by only a single ♀, which deviates from the normal in its wing-venation (fork 1 of fore wing sessile), so I only place it provisionally in this genus. It is remarkable that a second ♀ is present, closely resembling the first in colour but distinct therefrom in its venation (fork 1 of fore wing shortly pedicellate; fork 1 also present in hind wing; see further below).

Antennæ slender, clearly shorter than the fore wings, their segments elongate, without oblique black lines. Maxillary palpi with segment i. very short; ii., iii., and iv. of nearly equal length, iv. a very little shorter than iii., these two both somewhat thickened; v. slender, only as long as iii.

and iv. together. Hind part of head with two large wart-like prominences above, which touch the hind margin of the eyes and reach the middle of the hind margin of the head. Spur-formula 2, 4, 4; middle legs not widened, middle tibiæ only somewhat flattened. Nervature (fig. 15) differing from the normal for *Hydropsychodes* particularly in the following points:—discoidal cell of fore wing large, fork 1 sessile, not longer than the discoidal cell, which therefore is slightly advanced towards the apex. The front wings have a pattern of spots remarkably like that of *Chimarrha abyssinica*, Banks.

The whole body is black, only the lateral marginal seams of the abdomen greyish white, end of the abdomen brownish yellow, and the prominences on the hind part of the head brown; hairs on head and thorax golden-brown. Antennæ with first segment brownish black, the following segments brown, in the last two-thirds of the length blackish brown. Palpi dark brown. Legs brown, coxæ black, femora and the last two or three tarsal segments dark brown to black-brown. Wing-membrane grey; fore wings with close and almost adpressed copper-brown hairs and with some silvery- or whitish-golden-haired spots; several of these spots, small and merely punctiform, lie in the apical cells, a large round mark fills the basal two-thirds of the discoidal cell and the adjoining part of the following interval; a second, more elongated, spot lies on both sides of the first

Fig. 15.



Hydropsychodes bimaculata ♀; wings.

anal vein, about from the cubito-anal cross-vein onwards towards the base; veins dark brown, marginal fringes black-brown; hind wings rather translucent, with hairs scantier than on the fore wings, black-brown, the wings similarly coloured, also their marginal fringes and the veins, which stand out clearly. Last tergite (♀) bluntly conical. ♂ unknown.

Length of body 4½ mm.; of fore wing 6 mm.; expanse of wings about 13 mm.

Loc. Ravine at Wachacha, S.W. of Addis Ababa, ca. 8000 feet, 9. ix. 1926, 1 ♀ (*Scott*).

Note.—The second ♀ referred to above is larger, with a body-length of 6 mm., the fore wings 10 mm. long, and the expanse of the wings 21 mm. It differs from the type as follows:—wart-elevations on hind part of head yellowish brown, hairs on head and thorax darker brown (antennæ and most of palpi broken off), fore and hind wings alike dark, hairs, venation, and marginal fringes of both pairs of wings black-brown, hind wings somewhat translucent, the light marks on the fore wings golden, the discoidal spot rather larger, the punctiform spots in the apical cells rather clearer; legs black-brown, tarsi with lighter rings, middle tibiæ dark brown, hind tibiæ yellow. In the fore wing the discoidal cell is shorter, fork 1 is clearly though shortly pedicellate; in the right hind wing a fork 1 with long pedicel is clearly present, in the left hind wing it is very vague, practically absent; the cross-vein between radius and discoidal cell in the hind wing forms the continuation of the discoidal cross-vein, and thus lies nearer the apex than in the type.

Loc. Holota, near Addis Alam, ca. 8000 feet, from the face of the waterfall just below the bridge, 12. x. 1926, 1 ♀ (*Scott*).

6. *Adicella triænodiformis*, sp. n. (Figs. 16 & 17.)

♀. Head yellow, thorax brown-yellow, abdomen yellow-brown; hairs on the head very light yellowish white, on the thorax more yellowish. Antennæ whitish, the segments of the first third clearly dark-ringed, basal segment yellowish. Palpi greyish yellow, with yellowish-grey hairs, segment i. of maxillary palpi fairly long, as long as iv., ii. about 1⅓ times as long as i., iii. a little longer still, v. as long as ii. Legs greyish, with silky white shimmer; spur-formula 1, 2, 2. Fore wings relatively narrow, membrane almost colourless, very faintly grey, hairs golden-yellow, with some silver-white and black marks ; short streaks in the longitudinal intervals near the base are black-haired, also a point in about the first third of each of the apical cells ii., iii., iv., v. (these dark points lie in a curved line, and that in cell iii. lies furthest from the anastomosis), and, further, about six half-moon shaped little marks round the apical margin in the apical cells ; finally there are more scattered black hairs at the anastomosis, scarcely lying near enough together to form fine points, and scattered black hairs also in the apical part of the apical cell, where they almost crowd out the yellow hairs ; just basal to each of the black half-moon

Fig. 16.

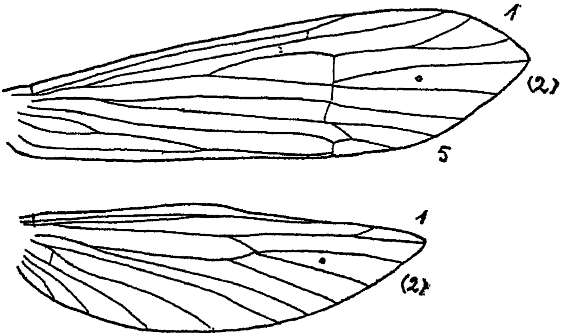
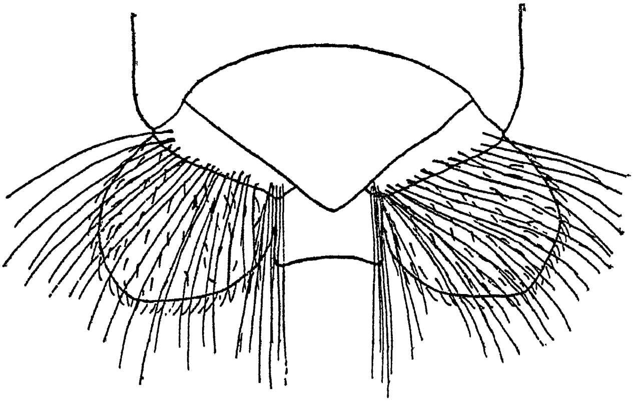


Fig. 17.



Adicella triænodiformis ♀.

Fig. 16.—Wings (hind wing slightly less magnified than fore wing).
Fig. 17.—Genital appendages, dorsal view.

shaped marks of the apical border is a little silver-white spot, and these spots, gradually narrowing, reach a little way into the apical cells; marginal fringe golden-yellow, appearing dark under oblique illumination; veins not very evident, only the apical veins are somewhat darker. Hind wings grey, strongly iridescent, hairs and marginal fringe dark golden-grey, the latter, especially on the hind margin, usually appearing dark, almost black-grey; veins brown, fairly clear. Nervature (fig. 16), apart from the presence of a thyridium-cell in the fore wing, very like that of *Triænodes*; in the fore wing the third apical cell is sharp and appears as a fork of the lower branch of the sector, that is, like a fork 2; in the hind wing the third apical cell is likewise sharp and rises from the vertex of the converging cross-veins. The ♂ is unknown. The abdomen of the ♀ (fig. 17) ends in a median rectangular plate, with somewhat concave hind margin, and two lateral, rounded, larger plates, hollowed like shallow dishes on the ventral surface; long bristles, arising from the last complete tergite, lie over the lateral plates.

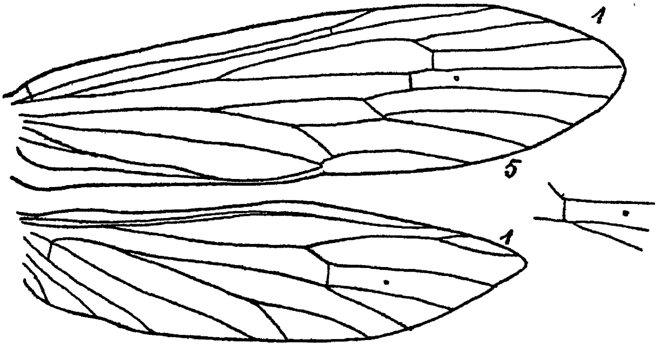
Length of body 6 mm.; of fore wing 7 mm.; expanse of wings about 15 mm.

Loc. Doukam (two stations below Addis Ababa on the railway-line to the coast), 6500–7000 feet, 19. x. 1926, 1 ♀ (*Scott*).

7. *Œcetis montana*, sp. n. (Figs. 18 & 19.)

♂. Body yellow-brown, head brown above, abdomen black-brown above, especially on the middle and posterior segments. Hairs of head and thorax brownish yellow. Antennæ (broken) yellow-brown. Palpi yellow-brown, closely covered with shaggy black-grey hairs; segment i. short, ii. about 2½ times as long as i., iii. rather shorter than ii., iv. and v. each shorter than iii. but much longer than i. Legs brownish yellow, tibiæ and tarsi rather darkened on the outer edge; spur-formula 1, 2, 2, spur of the front tibia very short. Fore wings strongly narrowed towards the blunt-pointed apex, hind wings narrower than fore wings. Membrane faintly grey; fore wings with close, smooth, yellow-brown hairs, mixed with blackish hairs in the apical half; at the anastomosis and at the points of division of the longitudinal veins these black hairs meet together in not very clear spots, while in the apical cells they are scarcely arranged as spots at all; marginal fringes yellow-brown, dark grey-brown in the apical part of the hind margin, where they are longest; veins brownish yellow, as a whole not very strongly marked. Hind wings iridescent, appearing rather darker than the fore wings, with similar but more scattered grey-brown hairs, dark grey-brown marginal fringes, and similarly coloured, very evident, veins. In the fore wing (fig. 18) the discoidal cell is 1½ times as long as its pedicel, and the thyridium-cell is rather shorter than the first-named cell, beginning nearer the base, but not reaching so far towards the apex; all the apical cells are sessile; apical cell i. impinges a little on the discoidal cell and ends obliquely; apical cell ii. shorter and truncate; cell iii. reaches about as far as i. along the discoidal cell and is also truncate; cell iv. longer than the preceding and ending obliquely, and its boundary (that is, the third cross-vein of the anastomosis—in other words, the cross-vein of the thyridium-cell) has a similar slope to that of cell i., *i. e.*, towards the base from the hind end forwards; cell v. is shorter than cell iv., but longer than the preceding, it abuts on the lower corner of the thyridium-cell and runs to a sharp point; cell vi. is the longest of all the apical cells and extends about to the middle of the lower side of the thyridium-cell; the three cross-veins of the anastomosis are arranged like steps, the foremost nearest the apex, the two latter successively nearer the base; the first two are nearly straight (the first a little oblique) and removed one from the other by somewhat more than their own length; the third

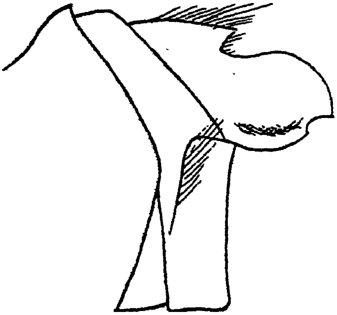
Fig. 18.



Œcetis montana ♀; wings (the little detached diagram shows the pedicellate apex of apical cell iv. in the left hind wing, reversed, for better comparison with the same parts in the right hind wing).

is very oblique and double as far from the second as the second is from the first. In the hind wing apical cell i. is about ⅓ as long as its pedicel; ii. is the longest, and ends obliquely; iii. rather shorter, and truncate; iv. is shortly pedicellate in the left hind wing, sessile and running to a point in the right hind wing, so that the cross-vein of the anastomosis meets the media before its point of division in the left, but right at the point of division in the right, hind wing; terminal fork 5 lies far back and is wide, its upper margin about as long as that of cell iv., its lower margin only about ⅓ as long. The abdominal appendages (♀) have evidently not assumed their correct relative positions in drying, therefore the figure (fig. 19) is not quite exact. ♂ unknown.

Fig. 19.



Œcetis montana ♀; genital appendages, lateral view.

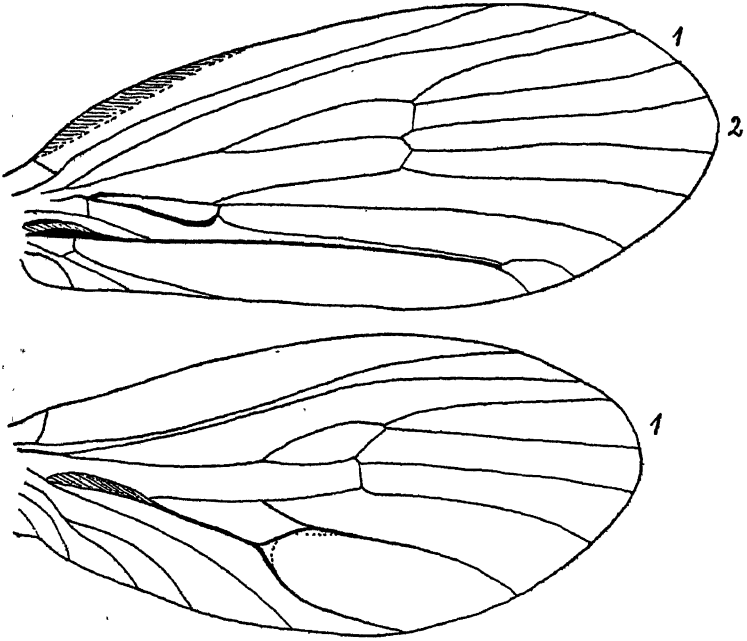
Length of body 5½ mm.; of fore wing 8 mm.; expanse of wings about 17 mm.

Loc. Near Addis Alam (about 20 miles W. of Addis Ababa), ca. 8000 feet, 12–13. x. 1926, 1 ♀ (*Scott*).

8. *Crunœciella scotti*, sp. n. (Figs. 20–22.)

♂. Body brownish yellow, only the pronotum and front part of the mesonotum darker, the last four or five abdominal segments grey-brown with long bristle-hairs near their hind margins. Hairs on head and thorax dull golden or yellowish grey. Antennæ ochreous yellow; segment i. twice as long as the head, more greyish yellow, with long hairs and short scale-hairs in between, all of them light greyish yellow; the following segments finely brown-ringed at the points of articulation; the front part of the head beneath the antennæ and between the eyes forms an almost circular hollow, in which the short maxillary palpi, clothed with black-grey hairs and scales, can be laid; labial palpi ochreous yellow. Wings (fig. 20) broad and blunt, somewhat lighter than in *C. sjöstedti,* Ulm., yellowish grey; fore wings closely set with little dull golden scales, only the anal region with long yellow hairs, at the base also with half-upright black hairs on and between the thickened veins (see further below); the bent-over basal part of the front margin is more brown-scaled; marginal fringes yellowish, appearing greyish brown under different illumination; veins scarcely darker than the membrane, light brownish yellow, only the thicker parts of the veins are dark brown. Hind wings not scaly, iridescent, tolerably thickly set with little brown-yellow hairs, which appear dark grey when otherwise illuminated; towards the costa and apex the hairs stand closer and in the costal space they are also longer; marginal fringes greyish yellow, appearing brownish grey when otherwise illuminated, those

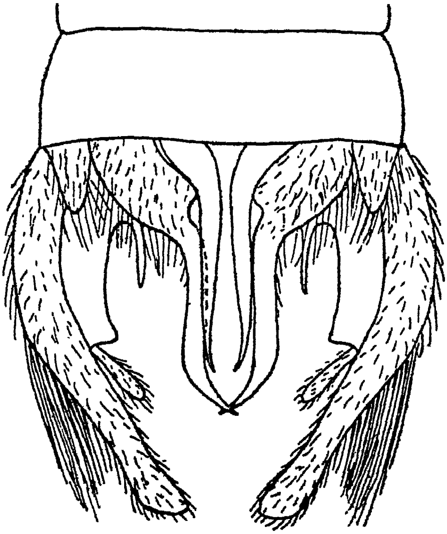
Fig. 20.



Crunœciella scotti ♂; wings.

on the hind margin long; veins brownish yellow. In the fore wing the basal part of the costal space is bent over upwards; discoidal cell somewhat shorter than first apical cell, thyridium-cell much shorter and extending towards the apex only as far as the base of the discoidal; apical part of thyridium-cell completely bare, and its lower margin as far as this bare place thickened and brown; cubitus sharply bent upwards at the apex of the thyridium-cell, and thence running as a fine vein nearly parallel, and in its distal part quite near, to the thickened first anal vein, with which it forms at the wing-margin a short broad fork; only terminal forks 1, 2 are present, all the apical cells are long and sessile. In the hind wing the discoidal cell is short, only fork 1 is present, and this is sharp; cubitus strongly bent at about the middle of the wing (opposite the base of the discoidal cell) and united by a cross-vein with the media at the beginning of the bend, so that a broad (false) terminal fork arises. Genital appendages of ♂ (figs. 21, 22) like those of *C. sjöstedti*, Ulm.; tenth tergite cleft into four pieces, recalling fish-bones, the inner pair of these is shorter than the outer and their points are bent inwards and upwards, while

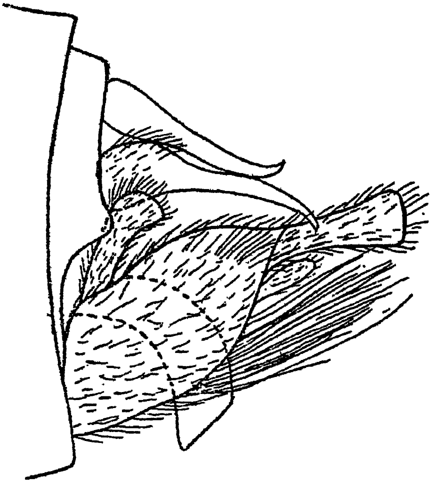
Fig. 21.



Crunœciella scotti ♂; genital appendages, dorsal view.

the outer pair, arising from stouter, hair-covered bases, lie in a lower plane that the inner; "genital feet" longer than the tenth tergite, two-segmented; first segment very broad, united before its apex to the narrow second segment, which has a rather club-like thickening apically; the first segment also bears, near the base above, an inner narrow branch, broadened at the apex; beneath the second segment there rests on the first a feebly clavate appendage, almost entirely hidden by strong bristles, as it were a second terminal segment; penis stout, in dorsal view its apex is widened and curved downwards; quite near the base of the "genital feet" is visible in dorsal view on either side yet another finger-shaped appendage on the ventral surface, which appendage in ventral view is also clearly visible and shorter than in *C. sjöstedti*.

Fig. 22.



Crunœciella scotti ♂; genital appendages, lateral view.

♀ distinguished as follows:—first antennal segment set, not with scale-hairs, but with strong outstanding greyish-yellow and black hairs; maxillary palpi ochreous yellow, with black and greyish-yellow hairs; wings rather narrower than in the ♂, not scaly, fore wings set with golden-yellow hairs, with longer half-upright yellow hairs also on the principal longitudinal veins, these longer hairs appearing black in certain illuminations; marginal fringes blackish grey, here and there on the apical margin golden; veins brownish yellow. Hind wings as in the ♂. Fore wings with basal part of costal space not bent over; thyridium-cell almost as long as discoidal, and extending towards the apex beyond the base of the discoidal, its apical part not so pronouncedly bare and its lower margin not thickened; anal veins not amalgamated, forming no fork; terminal forks 1, 2, 3, 5 present, all the apical cells long and sessile. In the hind wing terminal forks 1, 2, 5 are present, fork 1 is almost sharp; course of veins and extent of cubitus normal. The nervature of both wings is but little different from that of *C. sjöstedti*, figured by me in 1908, only in the hind wing fork 1 is sessile and fork 5 larger.

Length of body 6–7 mm.; of fore wing 11 mm.; expanse of wings about 23 mm.

Loc. Jam-Jam Forest*, ca. 9000 feet, from deep shady forest, 10. x. 1926, 5 ♂, 1 ♀ (*Scott*); beaten from foliage of an isolated giant juniper (*Juniperus procera*) in the same forest, 4. x. 1926, 1 ♀ (*Scott*).

The ♂ is easily differentiated from that of *C. sjöstedti* both by its nervature and genital appendages; but the ♀ of the two species seem hard to distinguish.

LARVÆ.

The collection contains but few:

i. *Hydroptila* sp., empty cases. Douber River, N. of Addis Ababa, ca. 8500 feet, from rocks in cascades, 5. i. 1927 (*Scott*).
ii. *Orthotrichia* sp., 1 larva in case. Same data as preceding.
iii. *Hydropsychodes* (?) sp., 1 larva. Same data as preceding.
iv. *Hydropsyche* (?) sp., 1 larva. Mulu, N. of Muger Valley, ca. 8000 feet, from rock-face of small waterfall, 20. xii. 1926 (*Scott*).
v. *Chimarrha* sp., several larvæ. Same data as no. iv.

Note.—As the species to which the larvæ belong cannot be determined, descriptions are unnecessary. The generic determinations seem sure enough, except those of iii. and iv. No. iii. might also be a small *Hydropsyche*, and no. iv., which is somewhat larger, a *Hydropsychodes*. The *Chimarrha*-larvæ look like our European *Philopotamus*-larvæ.

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* Also written Djem-Djem. About 45 miles W. of Addis Ababa.

II. EPHEMEROPTERA.

1. *Polymitarcys savignyi*, Pictet.

The examples of this species are preserved in formol and have darkened.

Loc. Lagalafto Ravine *, between Hawash River and Lake Zwai, ca. 6000 feet, 31. x. 1926, 2 ♀ (*Scott*).

2. *Tricorythus abyssinicus*, sp. n. (Figs. 23 & 24.)

♂ (dried example). Head black, with a little greyish-yellow translucence; eyes coal-black, small, the intervening space twice as wide as the breadth of an eye; antennæ greyish black, the funicle lighter. Pronotum with greyish ground-colour, but all the margins, the middle line, and an oblique stripe on either side from the shoulder to the middle of the hind margin, are broadly black, so that the light ground-colour is much covered over. Mesonotum and metanotum shining chestnut-brown, but the front part of the mesonotum and its sharply prolonged apex are blackish grey. Abdomen dirty grey-black above, its margins black; its ventral surface similar but rather lighter, with a translucent lighter figure on each of the sternites (at least the middle ones); this figure lies nearer the front margin and consists of a pair of lines diverging towards the anus and a pair of spots lying behind them. Caudal setæ smooth, greyish white, the joints and margins narrowly black. Legs with coxæ, femoral rings, and tarsi yellowish, the former with a large black mark on the outer surface, the latter ringed with black at the joints; femora black, but their bases yellowish, tibiæ black with yellowish translucence. Wings evidently with a blackish-grey tone, almost transparent, veins black, cross-veins very fine; in the costal space apparently no cross-veins; in the anal space intercalary vein 1 forms with anal vein 2 a broad fork, which includes intercalary vein 2; this latter is at its base faintly continued to intercalary vein 1, with which it unites archwise; the membrane of the wing-roots which runs round the mesonotum does not extend at all beyond the apex of the latter. Genital appendages (figs. 23, 24) whitish grey; "genital feet" 2-segmented, shaped like little narrow rods, second segment rather longer than first and bent inwards, gradually narrowed towards, but not sharp at, the apex ; penis forming a straight rod, consisting of two closely adpressed halves, which almost unite towards the apex into a long point*; tenth sternite convex at the hind margin.

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* [This name is not on any map I have seen, but was taken from our interpreter as nearly as I could get it. The place is a deep gorge with precipitous sides, perhaps 200 feet high, which we came on very abruptly in dense dry bush. Its direction is from a little W. of N. to a little E. of S., through gently undulating country. There was only a trickle of water in the gorge.—HUGH SCOTT.]

Fig. 23.

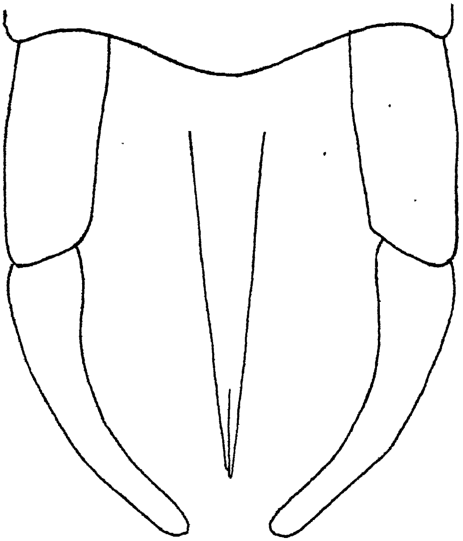
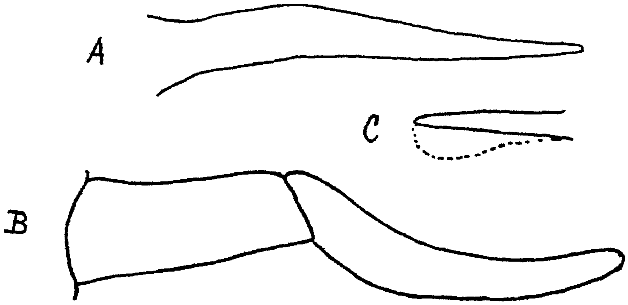


Fig. 24.



Tricorythus abyssinicus ♂.

Fig. 23.—Genital appendages, ventral view.
Fig. 24.—Genital appendages, lateral view. A, penis ; B, genital foot ; C, apex of penis and drop of dried seminal fluid.

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* As fig. 24 C shows, the penis bears beneath the apex a little drop of dried seminal fluid.

♀ (dried example). Coloration very like that of ♂, wings much darker, blackish, dull; legs also darker on the whole; intercalary vein 2 runs clearly into intercalary vein 1; here also there is no membrane extending beyond the apex of the mesonotum; caudal setæ hairy.

Length of body 4 mm. (♂), 5 mm. (♀); of wing 6 mm. (♂), 7 mm. (♀); cerci of ♂ three times as long as body (those of ♀ broken off).

Loc. Ravine of the Akaki River, S.E. of Addis Ababa, 6500–7000 feet, at candle-light in tent, 17. x. 1926, 1 ♂, 1 ♀ (*Scott*).

Note.—I place here a second ♂, taken at the same time and place, and now in my collection. It is somewhat smaller than the type, its coloration is rather lighter, and, in particular, the wings have only a very little, scarcely noticeable, blackish-grey tone. It presents no difference in the form of its genital appendages.

The new species, indeed, stands very close to *T. varicauda*, Pict. (Egypt), but is distinguished by its darker colouring and the different form of the penis. *T. poincisi*, Nav. ('Brotéria,' 1926, p. 100, fig. 13), from Nairobi, Kenya, seems to be similar, but nothing is said in the description about its genital appendages.

The African species of *Tricorythus* can, perhaps, be distinguished in the ♂ sex as follows—setting aside *T. sjöstedti*, Ulm., and *T. poincisi*, Nav.:—

1 *a*. "Genital feet" 3-segmented; penis broad and leaf-shaped in ventral and lateral view	*T. latus*, Ulm.
1 *b*. "Genital feet" 2-segmented	2.
2 *a*. Second segment of "genital feet" about three times as long as first, bluntly rounded off at the end; penis not cleft, not quite continuously tapering from base to apex, but showing a swelling in the middle (in ventral view), blunt-pointed at apex	*T. discolor*, Burm.
2 *b*. Second segment of "genital feet" at most one-and-a-half times as long as first, narrowed towards the apex, which is sharper	3.
3 *a*. Tenth sternite very strongly triangularly produced in the middle of its hind margin; penis very long, with the form of a slender little rod, somewhat swollen out and shortly cleft at the apex	*T. longus*, Ulm.
3 *b*. Tenth sternite with only a feeble rounded prolongation in the middle of the hind margin; penis not so long	4.

4 *a*. Penis evenly narrowed almost to a point, the cleft not distinct	*T. abyssinicus*, sp. n.
4 *b*. Penis less narrowed towards the apex, rather thickened in the middle, the cleft distinct and deep, the lobes not sharp at the apex but rounded off	*T. varicauda*, Pict.

3. *Cænis scotti*, sp. n. (Fig. 25.)

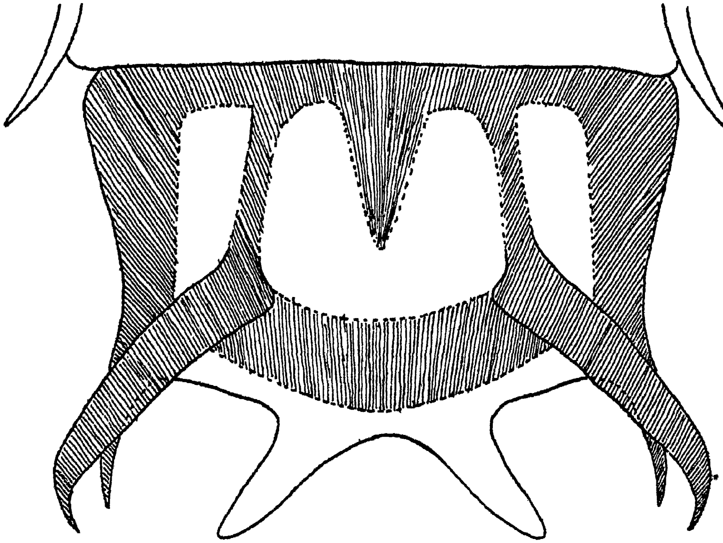
♂ (dried example). Head and eyes black, antennæ blackish grey, pronotum blackish grey with narrow black margins; meso- and metanotum pitch-brown, the former darker at the apex and with sutures narrowly black. Abdomen blackish grey, or olive-grey in transmitted light, the joints darker, the middle line along the back dark; rather lighter beneath than above; the long processes of the hind angles of the last segments (v. to ix.) are light-coloured. Legs blackish grey, front legs as a whole rather lighter than the hinder pairs; femora narrowly black along the upper, light blackish grey along the lower, edge, with dark olive-grey translucence; front tibiæ and all the tarsi lighter grey, base and apex of tibiæ black. Caudal setæ light blackish grey; the first seven or eight segments always lighter at the base than at the apex, narrowly black at the joints; last segments evenly light blackish grey. Wings very translucent, colourless, but the costal and subcostal spaces have a blackish-grey tone; the first three, and in less degree also the remaining, longitudinal veins are grey-black in reflected light; in transmitted light all the veins, excepting the thicker parts of the first three, are translucent whitish. On the last sternite (fig. 25) the lateral parts, a median elongated-triangular or tongue-shaped mark arising from the base, and the hind margin are broadly black, while the rest of the sternite is lighter; the "genital feet" also are black, the penis light; the former are long and narrow, ending in a slender curved point; penis deeply concave at its hind margin, with an almost semicircular emargination, so that the finger-shaped lobes diverge. Last five abdominal segments drawn out at the hind angles into long thorn-like processes.

♀ (preserved in alcohol). Eyes much smaller than in ♂, black. Head and pronotum black-brown, mesonotum black, metanotum black-brown; abdomen dark brown with light yellowish margins. Caudal setæ dark grey, about the first eight segments blackish, hairs short, erect. Lower surface of body lighter, dirty yellowish, margins of thoracic segments black, abdomen brownish grey with light margins;

hind angles of abdominal segments v.–viii. drawn out into short pointed processes. Wings transparent, colourless, the costal and subcostal spaces with a rather brownish-grey tone; veins very clear against a whitish background, dark brown to almost black-brown; in oblique light they look whitish, only the subcosta, radius, and large cross-vein remain dark.

Subimago (examples preserved dry and in alcohol). Entirely dark, wings blackish-grey, caudal setæ dark grey.

Fig. 25.



Cænis scotti ♂; genital appendages, ventral view.

Length of body 4 mm. (♂), 5 mm. (♀); of fore wing 4 mm. (♂), 5 mm. (♀); expanse of wings about 9–11 mm.

Loc. Near Addis Alam, ca. 8000 feet, 19. ix. 1926, 1 ♂, dried ex. (*Scott*); ravine of Akaki River, S.E. of Addis Ababa, 6500–7000 feet, at candle-light in tent, 17. x. 1926, 1 subimago, dried ex. (*Scott*); Debra Libanos, ca. 8000 feet, 2. i. 1927, 7 ex., ♀ and subimago, in alcohol (*Scott*).

A second ♂, taken at the same time and place as the ♀ listed above, is lighter coloured. I prefer not to describe it, as the genital appendages are not quite intact.

Note.—This species, which resembles our *Cænis macrura*, Steph. (*halterata*, Fabr., Eaton), even down to the colouring of the last sternite, is a true *Cænis* (not *Cænodes*), since the front legs of the ♂ are of a length quite typical of the genus. *Cænis haywardi*, Navás (Bull. Soc. Roy. Ent. d'Egypte 1926, p. 211 (1927)), from Assouan and *C. fasciata*, Navás (Mem. Soc. Ent. Ital. vi. p. 89, fig. 3 (1927)), from Somaliland, are unknown to me; nothing is said in the descriptions about their front legs or genital appendages, but it is to be hoped that they are really species of *Cænis*.

4. *Centroptilum* sp.

It is useless to describe the material, since this consists only of subimagines.

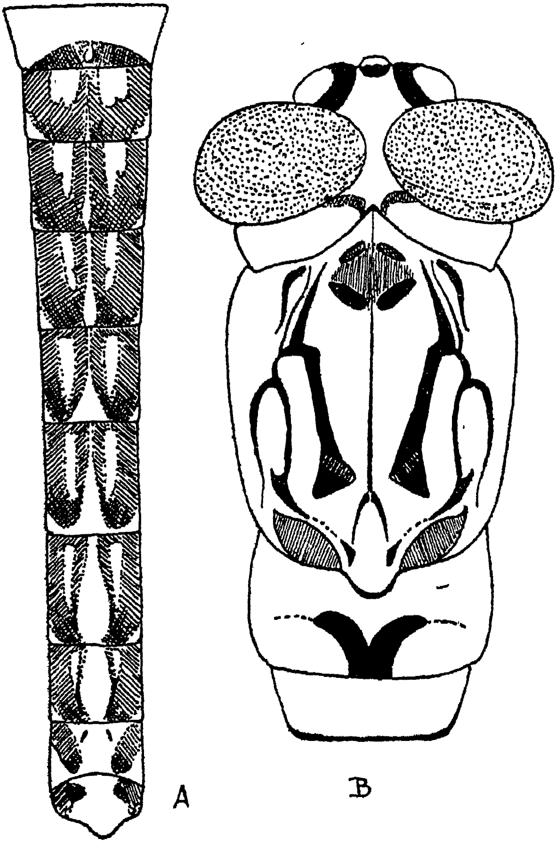
Loc. Ravine at Wachacha, S.W. of Addis Ababa, ca. 8000 feet, 9. ix. 1926, 2 subimagines, in alcohol (*Scott*).

5. *Afronurus pulcher*, sp. n. (Figs. 26–28.)

In this case again there are only subimagines in the collection; but the characteristic pattern on thorax and abdomen justifies naming and description of the species.

Subimago ♂ (in alcohol). Eyes leaden-blackish, often with a narrow, dark purple-brown band round the margin; head (almost entirely occupied by the large eyes) yellow above, ocelli hemmed round with black. Thorax yellow or light yellow above, with clear dark markings (fig. 26). Front part of pronotum (much hidden by the eyes) margined with dark brown. Mesonotum with a median grey-brown patch in front, which is bordered anteriorly by two elongate-oval dark brown marks, posteriorly by two similarly shaped but larger black marks; on either half of the mesonotum a kneed black figure lies longitudinally but rather obliquely (approaching the middle line behind); this figure ends in the form of a sharp-pointed bayonet in front and of a broadened butt behind; from the knee-bend a fine dark brown line runs forwards (parallel to the "bayonet"), and a dark brown or brown-black sepentine line runs backwards, which latter extends to the margin of the mesonotal prominence and also sends off, from a little behind its point of origin (*i. e.*, near the knee-bend), yet another longitudinal branch, lying further outwards; this external branch and the above-described serpentine line together enclose a long-oval space; on either side of the mesonotal prominence lies an oblique dark brown mark, sharp at both ends (having about the form of a statoblast of the Bryozoan *Lophopus*); middle line of mesonotum sometimes brown, and in front of the prominence lies on either side a little black narrowly triangular spot, from which a curved brown line runs forward to the middle line; lastly, the mesonotum presents in front on either side, externally to the two longitudinal dark markings described above, an S-shaped, serpentine,

Fig. 26.



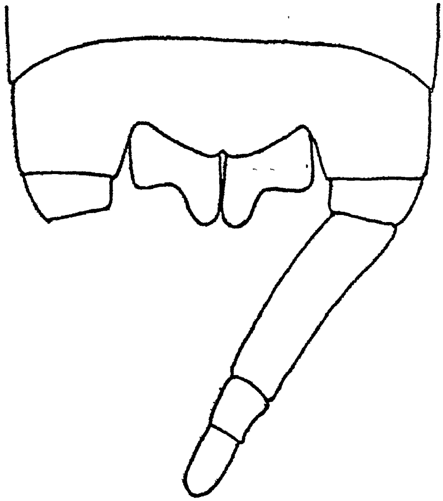
Afronurus pulcher ♂ (subimago).

A, dorsal view of abdomen; **B**, dorsal view of head and thorax.

longitudinal, black figure. Metanotum with a pair of black stripes curved outwards in front, touching one another in the middle line behind, and reaching the hind margin; they are together shaped rather like the front half of an X.

Abdomen yellowish, often with a weak reddish tone, ornamented with purple-brown marks; tergite i. with a dark area behind, with bow-shaped outline, the hind margin forming the string; the dorsum of the other tergites is crossed throughout by a broad dark stripe, in which the middle line and, in each of tergites ii. to viii., an elongated mark on either side of the middle, remain light; the light median part, very narrow on the front tergites, gets progressively broader on the posterior tergites, the dark lateral areas becoming narrower and further apart; the light lateral marks become gradually narrower from tergite ii. to viii.; the dark areas between the light middle line and the light lateral marks assume somewhat the shape of wedges from about tergite v. onwards; on tergites ix. and x. the light marks coalesce and the dark lateral areas become very small. Ventral surface of abdomen unmarked and having the yellow or yellowish tint which is the ground-colour of the whole body. Caudal setæ yellowish grey, with about the basal twelve segments clearly red or purple-red, with narrow darker rings at the joints. Legs yellow; outer surfaces of all the coxæ and apices of all the femora externally with a

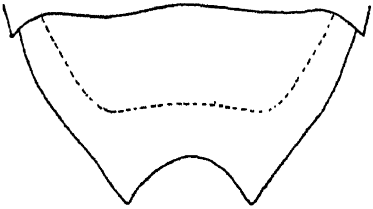
Fig. 27.



Afronurus pulcher ♂ (subimago); genital appendages, ventral view.

very clear black mark; in transmitted light the front legs, especially the tibiæ, are translucent reddish; front tarsi with segment i. almost as long as ii., and the segments diminishing in length in the following order: ii. and i. (about equal), iii. and v. (about equal), iv.; hind tarsi with segment i. 1½ times as long as ii., segments decreasing in length in the following order: v., i., ii., iii., iv. Front tarsus about two-thirds as long as the tibia, hind tarsus scarcely one-third as long as the hind tibia. Wings translucent yellowish grey, longitudinal veins yellowish, cross-veins (less clearly in the hind wings) black and narrowly bordered with grey-black, so that the wings look latticed; fore wings proportionately narrow. Genital appendages (fig. 27) with their contours already recognizable; last tergite prolonged on either side at the hind margin into a truncated process (which bears the "genital foot"), so that the hind margin is divided into three parts—a wider median, not extending so far back, and two narrower lateral; hind margin of the median part convex, rather bent in at the middle; lobes of the penis lying close together, shorter than broad, emarginate at the hind margin; their hind corners rounded off, broad, and the inner corners extending further back than the outer. "Genital feet" 4-segmented, segment i. short and broad, ii. the longest, iii. rather longer than i., iv. a little longer; iii. and iv. together about half as long as ii.

Fig. 28.



Afronurus pulcher ♀; end of abdomen, ventral view.

Subimago ♀ (in alcohol). Eyes much smaller, therefore concealing less of the surface of head and pronotum; head more or less washed over with grey-brown between the eyes and the pronotum, in front of the "marginal seam." Thorax and abdomen marked as in ♂, yet the patterns on the abdomen are often less clear or partly vanished; in particular the wedge-shaped stripes, and these again first on the posterior segments, can quite disappear, so that the light marks of each segment are very much expanded and only the elongated-quadrangular lateral marks remain of the dark parts; and even these may be faint, especially on the middle segments. Caudal setæ, wings, and legs coloured as in ♂, except that the front legs are often entirely yellow. Front tarsi with segment i. rather shorter than ii.; segments decreasing in length in the order v., ii., i., iii., iv.; front tarsus nearly half as long as front tibia. Hind legs as in ♂. Last sternite prolonged into a plate with converging lateral margins, and hind margin semicircularly emarginate, so that the hind angles are sharp (fig. 28).

Length of body 8–9 mm.; of fore wing 10–11 mm.; expanse of wings about 21–23 mm.

Loc. Muger River Valley, ca. 5500 feet, at light, 27.xii.1926, 4 ♂, 3 ♀, all subimagines; same place, 29.xii.1926, 1 ♂, 2 ♀, all subimagines (*all Scott*).

NYMPHS.

The numerous nymphs in the collection belong with one exception to the genera *Cænis* and *Cloëon*. The species cannot be determined. The material is as follows:—

1. *Indeterminable, perhaps Ecdyonurid* sp. Mulu, N. of Muger Valley, ca. 8000 feet, from rock-face of small waterfall, 20.xii.1926 (*Scott*).

2. *Cænis* sp. Serpent Lake, Wouramboulchi *, ca. 9000 feet, 2, 4, & 5.x.1926; stream below the same lake, 6.x.1926; Wouramboulchi, 7.x.1926; small stream S.W. of Mt. Zukwala [Zaquala], ca. 6000 feet, 30.x.1926; Hora Horeso, Lakes of Addas, ca. 7000 feet, 1.xii.1926 (*all Omer-Cooper*).

3. *Cloëon* sp. Addis Ababa, British Legation, Ponds nos. 1 & 2, ca. 8000 feet, 8.ix.1926; Serpent Lake, Wouramboulchi, ca. 9000 feet, 4 & 5.x.1926; stream below the same lake, 6.x.1926; Jam-Jam [Djem-Djem] Forest, about 45 miles W. of Addis Ababa, Pond no. 2, ca. 8000 feet, 26.ix.1926; Mt. Zukwala, in the crater-lake, ca. 9000 feet, 21 & 22.x.1926; mouth of Sucsuci River, Lake Zwai, ca. 5500 feet, 13.xi.1926; Lakes of Addas, Hora Horeso, 1.xii.1926, and Hora Bishoftu, 2 & 3.xii.1926, both ca. 7000 feet (*all Omer-Cooper*).

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* W. or N.W. of Jam-Jam Forest, that is, roughly W. of Addis Ababa, 50 miles or more; streams running eventually into Blue Nile System.

L.—*African Bees of the Genus* Megachile.

By T. D. A. Cockerell.

The bees recorded below were received from Sir Guy Marshall, of the Imperial Institute of Entomology, and all the species, including the holotypes, will be placed in the British Museum.

Megachile andersoni, sp. n.

♀.—Length about 15·5 mm.

Rather robust, black, including the broad mandibles, antennæ, tegulæ, and legs; mandibles without distinct teeth, but the broad apical tooth is defined by a notch; behind the cutting-edge is a band of deep red hair, and the base has a large but rather inconspicuous patch of greyish-white hair; lower margin of mandibles simple; clypeus densely rugoso-punctate, without any median line or keel, the lower margin simple except for a moderately arched, shining, transverse, thickened band or line; lower margin of supraclypeal area highly polished, and this involves a little of upper edge of clypeus; sides of face with dense pure white hair; cheeks beneath with long white hair; vertex and upper part of front with black or rusty-black hair; sides of vertex glistening between the punctures; mesothorax and scutellum dull and very densely punctured; mesothorax almost nude, but with thin brownish hair at sides and posteriorly; much black hair at sides of prothorax above tubercles, but the latter densely fringed with creamy-white; scutellum with thin greyish-white hair; thorax at sides and beneath with white hair; metathorax and first tergite with long, dense, pure white hair. Anterior wings dilute fuliginous, with violaceous tints, a dark fuliginous band along upper side of basal nervure, which falls considerably short of nervulus; marginal field paler than the area within the cells; hind wings hyaline. Legs with mainly white hair, rufous on inner side of tarsi, dense and pure white on outer side of middle basitarsi; hind basitarsi rather slender, not nearly as broad as tibia. Abdomen glistening; second tergite with dense white hair at sides, but a little red along the margin mesad of the white; tergites 2 to 4 with dense bright ferruginous hair-bands, very broad at sides, rapidly narrowing, on 2 and 3 represented in middle by a thin evanescent line, on 4 by a distinct band; fifth tergite with pale brownish hair; ventral scopa white, very faintly creamy, light brownish on last sternite.

5 ♀.—British East Africa (Tanganyika Territory), Serengetti Plains, 1916 (*T. J. Anderson*). The type-locality is Mbuyuni, May 24, but one specimen is from Maktau, Feb. 25.

It has much the aspect of *M. chrysorrhœa*, Gerst., but the clypeus, mandibles, and scopa are quite different. It really falls in the group of *M. mlanjensis*, M.-W., and in Meade-Waldo's table runs to *M. nigrifacies*, Vachal, which differs in a number of details. It may also be compared with *M. clypearis*, Fr., *M. cradockensis*, Fr., and *M. trichora*, Vachal, the last differing at once by the red scopa. It is marked "not named in B.M."

Megachile discolor, Smith (*füllaborni*, Friese).

♀.—Wad Medani, Sudan, 5. 7. 23 (*H. B. Johnston*); also Uganda, Busongoro Toro, Dec. 1927 (*G. D. H. Carpenter*).

Megachile rufiventris, Guérin.

♀.—Kenya Colony, Mombasa, on Tanga Road, S. of Mombasa Is., Sept. 13, 1921 (*A. H. Ritchie*).

Megachile marusa, Cameron.

♀.—Natal, Weenen, Dec. 1923 (*H. P. Thomasset*).

Megachile gratiosa, Gerstaecker.

♀ ♀.—Uganda: Kampala, Aug. 23, 1915 (*C. C. Gowdey*); Entebbe, June 20, 1913.

♂.—Uganda: Kabula, June 20, 1909 (*C. C. Gowdey*).

Megachile ritchiei, sp. n.

♀.—Length 18–20 mm.

Robust, but parallel-sided, black, including mandibles, antennæ, and legs; eyes slightly diverging below; mandibles very broad, with two large apical teeth and a long cutting-edge, lower margin not dentate; clypeus short, very coarsely and closely punctured, with no smooth line or keel, lower margin simple, appearing slightly crenulate if looked at from above; supraclypeal area granular, its lower edge very narrowly shining; vertex dull, finely rugoso-punctate; head with black hair, becoming noticeably rusty or dark brown on cheeks and front; mesothorax and scutellum dull and granular, with inconspicuous short pale hair (easily overlooked), and longer rusty-black hair; sides of thorax with dark greyish-brown hair, but fringe of tubercles lighter; metathorax with ferruginous hair, becoming pallid greyish brown on lower part; area of metathorax with a conspicuous pit; tegulæ dark reddish brown, the margin paler. Wings hyaline, the marginal field not darkened; stigma and nervures dark brown; basal nervure meeting nervulus. Legs with thin brown hair, black on inner side of tarsi; hind spurs black; hind basitarsi broad, but not as broad as tibiæ; first tergite covered with long very bright fox-red hair; second with much paler red hair, dull white hair at sides, and a dull white or reddish fringe; tergites 3 to 6 appearing bluish from a mixture of pale and black hairs, and 3 to 5 with dull white hair-bands; ventral scopa very pale yellow, on fifth sternite mainly black, but with yellow at extreme base, and a white apical fringe at each side; sixth pure black.

Four from Tanganyika Territory, Morogoro, June 9, 1925 (*A. H. Ritchie*).

Very close to *M. cyanura*, Ckll., but easily distinguished by the pale ventral scopa.

Megachile (*Creightonella*) *gastrodonta*, Cockerell.

♂.—British E. Africa, Kabete, Nov. 13, 1918 (*T. J. Anderson*).

This species, not published at the time of writing, was described from a male taken by Michael Bequaert at Lubumbashi, in the Katanga country. It has four spines on margin of fourth sternite, as in *M. mitimia*, Ckll., but they are all long and red. There is dark brown hair on vertex and mesothorax, the weak abdominal bands are white, and the teeth on keel of sixth tergite are red. The Kabete one differs from the type in being somewhat smaller, with the hair along hind margin of hind basitarsi light brown instead of dark.

Megachile maxillosa, Guérin.

♀ ♀.—Sudan: Gebelein, from mud-nest attached to rocks, Aug. 13, 1913 (*H. H. and D. King*); Wad Medani, at flowers of sessaban, March 20, 1923 (*H. W. Bedford*); also a smaller example, El Serag, Oct. 3, 1917 (*Capt. Bedford*).

Described from Senegal; several species of bees appear to range across Africa north of the forest-region. *M. pennata* of S. Africa is distinct.

Megachile pennata, Smith.

I have a female from German S.W. Africa (*Luebbert*) and a male from Willowmore (*Brauns*), both sent to me as *M. maxillosa*, of which *M. pennata* has been considered a synonym. It is a good species, readily distinguished by the dark brown portion of the wings reduced, not nearly reaching the basal nervure, and in the female the mandibles entirely black, narrower apically, with the upper margin toward the apex fringed with fulvous hair. *M. pennata* has dull white hair in region of antennæ of the female.

Megachile atropos, Smith.

Smith described this (1853) from a female, the locality being Gambia. Recently reading the description, I concluded that it must belong to the Anthidiinæ. Mr. Robt. B. Benson has kindly examined the type, and is of the same opinion. He reports that the venation is Anthidiine, and that there are no definite pulvilli. The species seems not to have been collected again.

I am just old enough to remember the conditions under which Smith worked in the basement of the Museum at Bloomsbury. It is, perhaps, not surprising that he could not always see things distinctly.

Megachile semivenusta, Cockerell.

♀.—Uganda: Mabira, Sept. 18, 1910 (*C. C. Gowdey*); Entebbe, Nov. 11, 1911 (*Gowdey*).

The Entebbe one has the tegulæ rufescent. This species is larger than *M. ancillula*, with broader face; it is near to *M. umbiloensis*, Ckll.

Megachile ancillula, Vachal.

♂.—Kampala, Oct. 6, 1915 (no. 5450).

Megachile opacula, Cockerell.

♂.—Uganda, Lubowa, Dec. 29, 1921 (*H. Hargreaves*); Kampala, Oct. 27, 1915 (*Gowdey*); T. T., Kilimanjaro, New Moshi (*Ritchie*).

Megachile callichlora, Cockerell.

♀.—Uganda; Busongoro Toro, Dec. 1927 (*G. D. H. Carpenter*). Differs from the type in having the abdomen hardly metallic. This is a species with bicoloured wings, the clypeus with no median keel, and the ventral scopa mainly red. It approaches *M. angulata*, Sm.

Megachile bilobata, Friese.

♂.—Kenya Colony: Kabete, 6000 ft., Nov. 5, 1918 (*T. J. Anderson*).

Very near to *M. antinorii*, Gribodo, but differing as stated by Friese. Compared with a female *M. cognatimorpha*, Strand, the wing-veins are not so heavy and the wings are not so dark. The type of *bilobata* was from Harrar, Abyssinia.

Megachile mombasica, sp. n.

♀.—Length about 15 mm., anterior wing 11.

Black, including mandibles, antennæ, tegulæ, and legs; head and thorax with black hair, except some pale between antennæ and eyes; mandibles broad, quite long, with an apical tooth, separated by a strong sulcus, and a long even cutting-edge, the margin broadly polished and shining; no subbasal tooth below; clypeus ordinary, not very short, convex, dull, and very densely punctured, with no trace of a smooth line, the lower margin even, but above its middle portion a transverse shining band; a shining band also across upper margin of clypeus; ocelli orange-fulvous; mesothorax and scutellum dull and very densely punctured. Wings hyaline, slightly flushed with orange; stigma and nervures ferruginous; recurrent nervures ending close to (and equally distant from) ends of second cubital cell. Legs with black hair, red on inner side of tarsi; spurs deep red; hind basitarsi not broadened. Abdomen dorsally covered with short, dense, very bright red hair, but first tergite with black basally; ventral scopa bright red, with an admixture of dark hairs on last sternite.

Kenya Colony; Mombasa, on Tanga Road, S. of Mombasa I., Sept. 13, 1921 (*A. H. Ritchie*).

"Unnamed in British Museum." Resembles *M. cognata*, Smith, but easily known by the hyaline wings. The mandibles also are quite different from those of *M. cognata*. The absence of a clypeal keel at once separates it from the smaller *M. intricata*, Sm.

Megachile leonum, sp. n.

♀.—Length 18 mm., anterior wing 11·2.

Black, including mandibles and antennæ (scape narrowly red at apex), but tegulæ clear ferruginous and legs chestnut-red, with the hind coxæ posteriorly raised into a high keel, pyramidal in lateral view; pubescence red, very bright fox-red, and short and stiff between antennæ, at sides of face, and on thorax above; a white tuft on tubercles and some long white hair at sides of metathorax; first tergite with white hair at sides, abruptly contrasting with the dorsal red; tergites 2 to 5 with lateral cuneiform patches of white hair, on 4 and 5 very narrowly continued across as a band, but the general effect, seen from above, bandless; ventral scopa light red, copper-red on last sternite; penultimate sternite with a narrow white marginal band, and the two before with the same at extreme sides only; mandibles elongate, with a broad apical tooth and an undulate cutting-margin, the second tooth fairly well defined, while behind the margin is a thin line of hair; clypeus rugose, entirely dull, with short thin hair, no keel or smooth line, lower margin straight but punctured; mesothorax and scutellum densely rugoso-punctate, slightly glistening on disc. Wings fuliginous, the base subhyaline and yellowish; nervures dark; first recurrent far from base of second cubital cell, but second recurrent very near to apex; hind basitarsi long and slender. Abdomen moderately shining dorsally; sixth tergite with rich red hair dorsally, greyish at sides.

British East Africa; Mbuyuni, Sarengetti Plains (Tanganyika Territory), May 24, 1916 (*T. J. Anderson*).

"Not in B.M." Allied to *M. fulva*, Smith, but easily distinguished by the appearance of the abdomen. It is a distinct and beautiful species.

Megachile mediorufa, sp. n.

♀ (type).—Length 13·3 mm., anterior wing 10·2.

Black, but the mandibles dark red, with the apical teeth black, flagellum dark red beneath, tegulæ black, legs very dark rufous; mandibles short and broad, with two strong apical teeth and a low rounded third one; face and front densely covered with white hair, hiding the surface, but two large tufts of pale fulvous hair at apex of clypeus; clypeus short, with simple margin; cheeks with long white hair, but that on vertex rather dark red; middle of vertex with a smooth line, pointing toward anterior ocellus; mesothorax and scutellum densely punctured, the former a little shining on disc; hair of thorax above and tubercles rather short, fox-red, the thorax posteriorly and extreme base of abdomen covered with very rich ferruginous hair; hair of mesopleura dark sooty brown. Wings dilute brown, upper half of marginal cell and a band above basal nervure strongly blackened; first recurrent nervure ending much more distant from base of second cubital cell than second from apex. Anterior and middle legs with dark brown hair, hind tibiæ and tarsi covered externally with white hair, the basitarsi with red hair on inner side; spurs red; hind basitarsi very hairy, not broadened. Abdomen above moderately shining, with strong green tints; tergites 1 to 5 with broad dull white hair-bands, that on fifth conspicuously overlapped by black hairs; sixth tergite with a mixture of black and white hairs, the apical middle dark brown; ventral scopa white, black on last sternite; base of abdomen beneath with the tegument bright red, elevated and obtusely cariniform in middle.

M. sudanica, Magretti, is 16 to 17 mm. long, but otherwise nearly the same; the present insect may represent a small race of *M. sudanica*. It has the aspect of a small *M. cærulea*, Friese, but is structurally quite different.

♂.—Length 11·5 mm.

Rather slender, parallel-sided; mandibles red only subapically; hair of vertex dark brown, but white hair on occiput behind; anterior coxæ well spined; anterior tarsi dark red, thick, but simple, with much black hair behind; abdomen with tegument of first two tergites clear ferruginous, with red hair, the second with a broad white fringe; venter clear ferruginous; sixth tergite covered with grey hair, with long black hairs intermixed, the transverse keel very broadly truncate, with a median spine ending a short high longitudinal keel, and with at each lateral corner a large thorn-like tooth, curved inward; seventh tergite with a prominent median spine, keeled above; fourth sternite with margin simple except a small inconspicuous median emargination. The caudal structures show an approach to the subgenus *Creightonella*.

Type (♀) from Bouga, Sudan, from ghemit-bush, 4.i.23 (*W. E. Giffard*). Males from Er Kowit, Sudan, May 21 and 24, June 10, 1917 (*H. H. King*).

In Friese's key the male falls nearest to *M. africana*, Mocsary, but there is no close resemblance.

Megachile patellimana, Spinola.

♀.—Khartoum, Sept. 1907 (*H. H. King*).

This extends into Asia; I have it from Deesa (*Nurse*).

Megachile flavipes, Spinola.

♂.—Sudan: Wad Medani, "in Takoma flowers," 4. ii. 23 (*H. W. Bedford*), and on flowers of petunia, 5. vii. 23 (*H. B. Johnston*).

♀.—Sudan: Wad Medani, Blue Nile, 8. iii. 22 (*Bedford*); Yembi River, 26. vii. 18 (*Bedford*); Khartoum, 24. xi. 20 (*Abdalla Eff. Hassan*).

This species also extends to Asia. The three Wad Medani females are smaller than the others.

Megachile masaiella, sp. n.

♀.—Length about 9 mm.

Mandibles dark red with black cutting-edge, the third tooth distinct; hair of face white, of vertex pale fulvous; flagellum unusually short, red beneath; hair of thorax white at sides, above short, with a pale fulvous tint; scutellum dull, appearing darker than mesothorax, with a strong grey hair-band in front and behind; tegulæ light rufo-testaceous. Wings clear, with no distinct apical cloud; stigma ferruginous; second cubital cell receiving recurrent nervures equally distant from (very close to) base and apex. Legs bright red, with the hind coxæ, trochanters, and femora black, abruptly contrasting; hind basitarsi broad, with white hair on outer side and orange-fulvous on inner. Abdomen with five entire conspicuous creamy-white hair-bands; sixth tergite with two round patches of greyish-white tomentum, narrowly separated in middle; tegument of venter red basally; ventral scopa clear white, black on last sternite. The clypeus is slightly ridged, with traces of a smooth line in middle, the lower margin simple; supraclypeal area polished and shining.

Kenya Colony: Masai Reserve, May 24, 1913 (*T. J. Anderson*).

"No name in B.M." Very close to *M. flavipes*, and at first seeming to be a mere variety, but clearly distinct by the characters described.

Megachile cinnamomea, Alfken.

♀.—Sudan: Khartoum North, taken on house, March 3, 1913 (*D. King*); Gendettu, "in cultivations," Feb. 15, 1924 (*W. E. Giffard*); Hag. Said, nesting in wall of rest-house, March 27, 1913 (*H. H. King*).

This pretty species was new when collected, but was described by Alfken in 1926. The Sudan specimens have the antennæ entirely clear red except for the dusky tip. It is closely allied to *M. farinosa*, Smith, from Bagdad, but much yellower.

Megachile bedfordi, sp. n.

♂.—Length 14–14·5 mm.

Black, including mandibles (a faintly reddish spot at shining base of apical tooth) and antennæ (flagellum simple, not expanded at end); facial quadrangle much longer than broad; face and front covered with long white hair; vertex with white, faintly tinged with brownish; cheeks with greyish white, but a large round black area on lower part; mandibles bidentate, and with a broad triangular lamina below; vertex dull; mesothorax and scutellum dull, thinly clothed with short pale brown hair; thorax posteriorly with long pale fulvous-tinted hair, reddest just behind the wings; mesopleura with dark greyish-brown hair; on underside of thorax the hair is greyish white; tegulæ very dark brown. Wings hyaline, dilute brownish, the apical cloud faint; recurrent nervures joining second cubital cell equally and very near to base and apex. Anterior coxæ with large spines; femora not enlarged, anterior ones bright ferruginous, the others brownish black; hind femora sharply keeled above, and on inner side of keel a depression containing an elongate patch of reddish tomentum, pale and shining in some lights; anterior tibiæ short and stout, trigonal, bright ferruginous, with the outer face infuscated; anterior tarsi cream-colour, greatly broadened, but without a boat-shaped process; on inner side is a black spot, and the outer surface is covered with shining silvery-white hair, with the end of the fringe red; middle tibiæ dark, but reddish in front, their tarsi with a very long fringe of pure white hair; hind tibiæ and tarsi dark reddish brown, with a white fringe in front, that on tarsi about twice as long as on tibiæ; small joints of tarsi quite red. Abdomen very finely punctured; first tergite covered with long fulvous hair, white at extreme sides; second to fourth with broad pale fulvous hair-bands in the apical depression, and third and fourth also with basal bands; fifth with very pale fulvous hair and long black hairs intermixed; sixth densely covered with pale grey tomentum, having a subapical pit, and the transverse keel broadly rounded, crenulate, the central emargination practically obsolete or rather distinct; seventh tergite unarmed; second sternite reddened; abdomen not at all metallic.

Sudan: type from Wad Medani, "from godwal," 12. ii. 24 (*H. W. Bedford*). Also from Geziret el Fil, "on *Lubia afin.*," 9. ii. 23 (*Bedford*); and Gendettu, "from ads sudani," 5. ii. 25 (*W. E. Giffard*).

In Friese's table it runs nearest to *M. flava*, Friese, but is much larger and otherwise different. It is actually closest to *M. saganeitana*, Gribodo, differing by the red front femora, pale hair on thorax beneath, different sixth tergite, &c. These males are suggestive of *M. sudanica*, described in the female, but not at all like the male of *M. mediorufa*, described above.

LI.—*Seven new Species of Brachyura from the Coasts of China.* By Isabella Gordon, D.Sc., Ph.D.

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INTRODUCTION.

Two collections of Decapoda, chiefly Brachyura, from China (one from Hongkong, presented to the British Museum (N.H.) by R. W. D. Barney, Esq., the other from Pei-tai-ho and Amoy, presented by C. J. Shen, Esq., Fan Memorial Institute of Biology, Pekin), include a number of rare and seven new species. Among the rarer species are (1) a species of the genus *Ixoides*, probably *I. cornutus*, MacGilchrist, but all three specimens are damaged; (2) *Lyreidus politus*, Parisi; (3) *Lissocarcinus arkati*, Kemp; (4) *Macrophthalmus teschi*, Kemp; (5) *Paracleistostoma depressum*, de Man, and, amongst the Anomura, three species of *Porcellana*—*P. ornata*, Stimpson, *P. pulchra*, Stimpson, and *P. spinulifrons*, Miers.

Special attention was paid to the anterior male abdominal appendages, which may prove to be of considerable taxonomic importance. In many instances species closely resembling each other show marked differences in these, although this may not be discovered until the appendages are examined under the microscope, and, leaving aside the genus *Pilumnus*, in no two species of the Xanthidæ examined were they identical.

In view of the fact that a colleague is at present working on Chinese crabs a preliminary description of the new species is given here, as the author's paper, with its many illustrations, may not appear for some considerable time.

The following species are described below :—

1. *Pugettia cristata*, sp. n.
2. —— *sagamiensis*, nom. nov. for *P. brevirostris*, Parisi, nec Doflein.
3. *Neptunus* (*Hellenus*) *alcocki*, nom. nov for *N. spinipes*, Alcock, nec Miers.
4. *Charybdis* (*Goniosoma*) *barneyi*, sp. n.
5. —— (*Goniohellenus*) *sinensis*, sp. n.
6. *Pilumnus penicillatus*, sp. n.
7. —— *sinensis*, sp. n.
8. *Litocheira amoyensis*, sp. n.
9. *Metaplax sheni*, sp. n.

OXYRHYNCHA.

Pugettia cristata, sp. n.

Material.—Two ovigerous ♀ ♀, 13 × 9·5 mm. and 12·7 × 9·6 mm. (holotype) respectively, from Amoy.

Description.—A small *Pugettia*, resembling *P. incisa* (de Haan)* in general outline, but with a high thin crest on dorsal margin of merus of anterior walking-leg. Crest shorter on second, still more reduced or obsolete on third, and absent on last leg. A dorsal crest on wrist and two prominent crests on arm of cheliped.

Remarks.—It was thought that these specimens might belong to *P. minor*, Ortmann (1893, Zool. Jahrb. Syst.

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* 1833–1850, "Fauna Japonica—Crustacea," in P. F. von Siebold, fol. 'Lugduni Batavorum,' pl. xxiv. fig. 3.

vii. p. 44), but, on comparing them with two cotypes from the Strasbourg Museum, this proved not to be the case. *P. minor* has a large, curved, spiniform, postorbital process followed by a small straight spine, instead of a single, large, wing-like postorbital process, and no crests on the meri of the anterior walking-legs.

Pugettia sagamiensis.

(Nom. nov. for *P. brevirostris*, Parisi, nec Doflein.)

Parisi, 1915, Pavia, Atti Soc. Ital. Sc. Nat. liv. pp. 287–288, text-fig. 2, pl. vii. fig. 1.

On comparing Parisi's specimen with the type of *P. brevirostris*, Doflein (1904, 'Valdivia' Brachyura, vol. vi. p. 85, pl. xxvii. figs. 13, 14), it proved not to be co-specific. The most pronounced difference between the two specimens lies in the walking-legs, the dactyli and propodi of which are much compressed in *P. sagamiensis*, slender and cylindrical in *P. brevirostris*. Moreover, *P. sagamiensis* has (1) a broad wing-like outgrowth instead of two spines posterior to the orbit; (2) postero-lateral border drawn into two lobes instead of armed with a single branchial spine; (3) two eminences (anterior one more prominent) instead of five on the gastric region; (4) vesicular outgrowths for the most part low, flattened, and scale-like, whereas in *P. brevirostris* they are everywhere rather long, and so mask the general contours of the carapace that at first sight it seems to approach to that of *P. sagamiensis*.

BRACHYRHYNCHA.

Neptunus (*Hellenus*) *alcocki.*

(Nom. nov. for *N.* (*H.*) *spinipes*, Alcock, nec Miers.)

Alcock, 1899, Journ. Asiat. Soc. Bengal. lxviii. pt. ii. no. 1, pp. 32 & 39–40.

Differs from *N. spinipes*, Miers, in the following points:—(1) angle at the junction of posterior with postero-lateral border much more spiniform; (2) lobes of the antero-lateral border much less pronounced, the three anterior ones almost obsolete; (3) lateral epibranchial spine much longer; (4) crests on second and third abdominal segments less prominent, but "elegantly denticulate," that on third segment not bilobed; (5) anterior ♂ abdominal appendages differ appreciably at the extreme apex, which is directed upwards in *N.* (*H.*) *alcocki*, downwards in *N.* (*H.*) *spinipes*.

Distribution.—Madras, Andamans, G. of Martaban, Arakan, Muscat, and Hongkong.

Charybdis (*Goniosoma*) *baryneyi*, sp. n.

Material.—Two ♂ ♂ measuring 50·5 × 32 mm. (holotype) and 43 × 28·4 mm. respectively, from Hongkong.

Description.—A *Goniosoma* with no transverse ridges on the pubescent carapace behind the level of the last spine, and with not more than three large spines on the anterior border of the arm (Alcock, 1899, Journ. Asiat. Soc. Bengal, lxviii. pt. ii. no. 1, group A. 1 of key on p. 49). Chelipeds just over twice length of carapace, armed with the usual spines; palm rather inflated, with six low costæ, one of which is on the inner, three on the outer surface. Sixth abdominal segment with sides parallel for about ⅔ of their length, then rapidly converging. Anterior abdominal appendage with distal portion curved outwards in sickle-fashion.

Remarks.—All the species included in Alcock's group A. 1 (1899, p. 49) and *Ch.* (*G.*) *japonica*, A. M. Edw., are represented in the British Museum collection. In *Ch.* (*G.*) *annulata* (Fabr.) a short portion near the apex of the anterior ♂ abdominal appendage is abruptly bent outwards at an angle of 90°. In all the other species these appendages are long and nearly straight, the distal third being directed slightly outwards. In *Ch.* (*G.*) *barneyi* the bending occurs at a lower level than in *Ch.* (*G.*) *annulata*, but is less abrupt.

This species from Hongkong appears to be most nearly related to *Ch.* (*G.*) *crucifera* (Fabr.) and *Ch.* (*G.*) *rivers-andersoni*, Alcock, and may prove to be identical with the *Ch.* (*G.*) "*affine*" of de Man (1887, Journ. Linn. Soc. London, xxii. no. 137, p. 80, pl. v. fig. 2) from Mergui.

Charybdis (*Goniohellenus*) *sinensis*, sp. n.

Material.—A ♂, 22·7 × 13·8 mm. (holotype), and 2 ♀ ♀, 20·7 × 12·3, 26 × 15·5 mm. (ovigerous); from Hongkong.

According to Alcock's key (1899, Journ. Asiatic Soc. Bengal, lxviii. pt. ii. no. 1, pp. 49–51, description on p. 66) would be identified as *Ch.* (*G.*) *hoplites*, Wood-Mason, but the male especially differs from that species in that (1) the lateral margins of the sixth abdominal segment are markedly convex instead of being straight and convergent, and (2) the anterior abdominal appendages are quite distinctive. In *Ch.* (*G.*) *sinensis* the anterior ♂ appendage has an unusually long, slender, distal portion resembling the neck, head, and beak of a swan; in *Ch.* (*G.*) *hoplites*, on the other hand, the apical portion is much shorter, slightly sinuous, and tapers gradually to a blunt point. There are other minor differences between the two species, *e.g.*, in *Ch.* (*G.*) *hoplites* (1) the antero-lateral teeth are distinctly square-cut and more conspicuously serrated on the outer border; (2) the scale-like granulations on the palm are more pronounced; and (3) the lobulations on the dorsal surface of carapace are more prominent than in *Ch.* (*G.*) *sinensis.*

Pilumnus penicillatus, sp. n.

Material.—A ♀ measuring 4·2 × 2·9 mm. (holotype), another ovigerous ♀, and a ♂ of approximately the same size as holotype, from Hongkong.

Description.—A small, unusually hairy *Pilumnus*, with numerous long, feathered, or brush-like setæ on chelipeds, walking-legs, eye-stalks, and front; a few scattered on dorsal surface of carapace. All three specimens characterized by the following curious pattern-arrangement of short clubbed setæ:—two medial rows on mesogastric region ending in a diamond posteriorly, on a level with the last antero-lateral lobe; a large somewhat irregular ocellus on each protogastric region. Similar short setæ occur elsewhere on the dorsal surface, but the arrangement of these is less definite and somewhat variable. Carapace broad; fronto-orbital border slightly exceeding length of carapace, two shallow emarginations in outer half of upper orbital border; external orbital angle prominent, dentate. Antero-lateral borders somewhat divergent, each quadridentate (including orbital angle), third and fourth teeth with outer margin serrate, fourth small. Postero-lateral rather longer than antero-lateral borders, slightly convergent. Chelipeds equal, approximately 1·5 times length of carapace; rows of minute granules beneath pilose covering of palm. Anterior ♂ abdominal appendage with a stout spine beneath the downturned apex.

Remarks.—This species differs from *P. quadridens*, de Man, *P. seminudus*, Miers, and *P. lævimanus*, Dana, chiefly in having the chelipeds equal and limbs and carapace unusually hairy.

Pilumnus sinensis, sp. n.

Material.—An ovigerous ♀, 24 × 18·7 mm. (holotype), and a ♂, 30 × 23·4 mm., from Hongkong.

Description of holotype.—Three antero-lateral spines directed forward and outward from expanded bases. *Two* spines at outer angle of orbit; a small spine and two granules on subhepatic region; lower orbital border armed with spines on inner, serrated on outer half. A deep fissure below outer orbital spines and two indistinct notches on upper margin. Antennal flagellum standing in gap between inner orbital angle and outer spiniform lobe of front; inner frontal lobes broad, separated medially by a narrow fissure. Chelipeds unequal; six to seven longitudinal rows of spines on palm, the larger spines curved, the smaller conical; three rows of spines on proximal upper half of dactylus; numerous curved spines on outer surface of carpus; a spine near the distal end of upper margin of merus. No spines on meri of walking-legs. Colour greyish white; anterior half of carapace and chelipeds with long, stiff, yellowish-brown bristles, those on walking-legs more slender.

Male.—Abdomen long and slender, seventh segment nearly as long as the sum of sixth and fifth segments; anterior pair of appendages long and slender, perfectly straight in anterior half, apex reaching forward to anterior end of sternal groove.

Remarks.—This species is most nearly related to *P. orbitospinis*, Rathbun (1911, Trans. Linn. Soc. London, xiv. 2, p. 229, pl. xvi. figs. 14 & 15), and to *P. spinohirsutus*, Lockington (Rathbun, 1904, Harriman Alaska Exped. x. p. 185, pl. vii. fig. 2). It differs from the former in having longer more curved spines on the chelipeds and no spines on the meri of the walking-legs (*cf.* Parisi, 1916, Atti Soc. Ital. Sc. Nat. lv. p. 185); from the latter in many respects, *e.g.*, (1) in the absence of spines on median frontal lobes and upper orbital border; (2) in the absence of spines on the walking-legs; (3) in having all spines white and slightly calcareous, instead of brown and presumably horny; and (4) in having the apex of anterior male abdominal appendages straight, not bent outwards and downwards.

Litocheira amoyensis, sp. n.

Material.—A ♂ measuring 6·4 × 4·6 mm. from Amoy.

Description.—Carapace quadrilateral; areolation faint; fronto-orbital width slightly less than length of carapace; antero-lateral shorter than postero-lateral border. Outer orbital angle rounded and confluent with the long anterior lobe of antero-lateral border; second lobe long and low, separated from first by a very shallow emargination; third lobe dentate, conspicuous; fourth a minute tooth. Eyestalk broadened at base, freely movable in orbit. Chelipeds equal; palm and base of each finger covered with a short brownish-yellow felt (thicker than that on dorsal surface of carapace), faintly granulose underneath; rest of fingers white, two sulci on fixed digit; a stout triangular spine on inner distal angle of wrist. Long silky hairs on palm, wrist, and walking-legs; on carapace a single row on the front. First abdominal segment covers all the space between the last pair of walking-legs; anterior pair of abdominal appendages cross over near the apices, which are bent inwards; male genital duct passes forward from base of last leg along a wide shallow groove in the sternum.

Remarks.—This specimen does not appear to agree with any of the species mentioned by Tesch (1918, 'Siboga' Monograph, 39 *c′*, *c*¹, pp. 163–165); although most nearly related to the *L. ciliata*, *angustifrons*, *cristata*-group, it differs from all three in that the third lobe of antero-lateral border is prominent, acute, not truncated.

Metaplax sheni, sp. n.

Material.—Two ♂ ♂, measuring 13·2 × 8·6 mm. (holotype) and 12·8 × 8·5 mm. respectively, from Amoy.

Description. — Infraorbital crest divided into 15–19 lobules; the first of these, by far the largest, faintly crenulate on the inner half; the second about half the length of the first; third to fifth gradually decreasing in size, and thereafter the lobules are small round beads. Two large, followed by two small teeth on antero-lateral border. Chelipeds large, equal, nearly twice length of carapace; most of merus projecting beyond carapace; palm long, fingers deflexed.

Remarks.—According to Tesch (1918, 'Siboga' Monograph 39 *c*, pp. 115–117), who revised the genus, the infraorbital crest in the ♂ is of "great systematic value." The position of the species in Tesch's key is as follows:—

2. Number of lobules of infraorbital ridge of ♂ 7–9 . 3.
Number of lobules of infraorbital ridge of ♂ 15–19 .... *M. sheni*, sp. n.

It is most nearly allied to *M. dentipes* (Heller) and *M. distincta*, H. M.-Edw., both of which have 25–30 lobules, but arranged differently.

LII.—*A new* Adoretosoma (*Col.*, Rutel.) *from Malaya*.

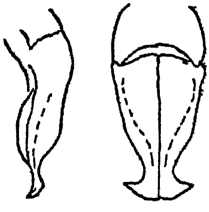
By Dr. F. Ohaus.

Adoretosoma citricola, sp. n.

A. fulviventris, Blanch., proxime affinis; paulo major, differt præcipue punctis elytrorum majoribus transversim impressis. Supra viridiænea polita, aureo splendore suffusa, thoracis lateribus anguste flavo-marginatis; subtus cum pygidio et pedibus flava cupreo splendore suffusa, tibiarum apicibus et tarsis omnibus nigris; antennis testaceis clava fusca. Clipeus trapezoidalis, angulis rotundatis, margine anguste elevato, dense rugulosus; frons dense, vertex disperse singulatim punctata. Thorax undique anguste marginato-sulcatus absque foveolis lateralibus, sicut scutellum disperse punctulatus. Elytra regulariter punctato-sulcata, punctis in sulcis annulatis transversim impressis, interstitio subsuturali punctis 3–4 basalibus solum instructo. Pygidium politum disperse punctatum, margine sparse pilosum; abdomen subtus et pectus paulo densius punctata, sparsissime pilosa; tibiæ omnes inflatæ. Ædeagi paramera symmetrica apice acute unidentata.

Long., ♂ 7½–8, ♀ 9; lat., ♂ 4, ♀ 5 mm.

Malaya: Tana Rata, 17. iii. 1930, ex *Citrus limonium*, L. (*N. C. E. Miller*).



Adoretosoma citricola, sp. n.

Closely allied to *fulviventris*, Bl., of the same shape and colouring, differing especially by the sculpture of the elytra, which are deeply striate-punctate, the punctures transversely impressed. The shape of the ædeagus (see fig.) is similar to that of *A. signaticollis*, Nonfr., but bears only one tooth at the apex of the paramera.

LIII.—*A new Subspecies of* Colomys *from Kenya.*

By Miss JANE ST. LEGER.

OWING to the kindness of Mr. R. E. Dent, of Nairobi, the British Museum (Natural History) has recently received two specimens from Kenya of the rare genus *Colomys*, hitherto only recorded from the Congo area. These two specimens seem to combine in some degree the characters of *C. goslingi* and *C. bicolor*, and I regard them as representing a new subspecies, which may be named

Colomys goslingi denti, subsp. n.

A *Colomys* with unusually light-coloured tail from Elburgon, Kenya, alt. 8000′.

Size about as in *C. goslingi*; coloration as usual conspicuously bicolor, the line of demarcation slightly lower than is usual in *C. goslingi*, but the dark line encroaching somewhat less on the fore-arm than in *C. bicolor*; dorsal surface as dark as in *C. bicolor*; hind legs with a ring of dark colour above ankles; feet and hands as in *C. goslingi*; white spot below the ear rather larger than in *C. bicolor*, not so conspicuous as in *C. goslingi*. Colour of tail quite different from that of either *C. goslingi* or *C. bicolor*, being rather light brown (Prout's brown, Ridgway) above, paler, almost white, beneath, instead of dark brown or blackish above and slightly paler below. Upper surface of tail sparsely clad with short blackish hairs, under surface with pure white hairs, which are more numerous, longer, and finer than those of the upper surface. Mammary formula 2—2.

Skull similar to that of *C. goslingi*. Brain-case rounded, rather flattened on top; palatal foramina with the peculiar expansion of the septum only slightly developed.

Type. Subadult male. B.M. no. 30.7.1.1.

Measurements (in mm.):—

Head and body 115; tail 180; hind foot 36; ear 18.

Skull: greatest length 33; breadth of brain-case 15; zygomatic width 15·3; interorbital width 4·8; length, nasals 12·3; length, upper molar series 5·4; greatest length, bulla 5·4.

"Lives in thick forest. Climbs trees."

The two species, *C. goslingi* and *C. bicolor*, were both described from single specimens, but since then a series of about sixteen skins has been added to the collection, and upon examination of these it becomes apparent that there is a considerable variation in the coloration of this genus, in the amount of dark colour on the upper surface of the fore-arm, and in the size of the ear-spot, all of which are cited as of specific value in the description of *C. bicolor*. The tails, however, of this series and of all those from the Congo area differ from that of *C. goslingi denti*, and agree together in being dark brown or blackish above, and rather paler below. *C. goslingi* is described as having a tail "practically naked." This is, I think, due probably to preparation, and in all the skins traces of hairs can be seen thicker and darker above, longer, paler, and finer beneath, as in *C. goslingi denti*.

Upon examination of the skulls, however, the type and only specimen of *C. bicolor* shows a skull with distinctly longer, more oval-shaped brain-case, higher or more rounded on top, whilst all those of the Eastern Congo and Kenya show a brain-case shorter, more circular in shape, and somewhat flattened on top. The large size, longer nasals, and narrower, more smooth-edged interorbital region, cited in the description of *C. bicolor* as being amongst its specific characters, can all be matched amongst some of the larger skulls from E. Congo. The peculiar expansion of the septum of the palatal foramina varies in size, although in none of the skulls is it so developed as to touch one of the walls of the septum as in the type of *C. bicolor*.

There remain, then, as constant characters, only the peculiar shape of the brain-case of *C. bicolor*, and the paler-coloured tail of *C. goslingi denti* to distinguish them from one another and from *C. goslingi*. The mammary formula of *C. goslingi* and of *C. goslingi denti*, is 2—2, whilst that of *C. bicolor* is described as "apparently 2—1," but this statement, with only one dried skin available for examination, awaits the verification of further collections, when it may be found feasible to consider *C. bicolor* too as a subspecies of the type-species *C. goslingi*.

LIV.—*Notes on Exotic* Chaoborinæ, *with Descriptions of new Species* (*Diptera*, Culicidæ). By F. W. Edwards.

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Although the family Culicidæ is probably without exception the best-known group of the whole class Insecta, the small subfamily Chaoborinæ, whose members are of little or no economic importance, has been somewhat neglected.

In the course of work on a catalogue of the mosquitoes, I have taken the opportunity of studying the subfamily Chaoborinæ also, and present herewith notes on the material which has accumulated in the British Museum from various tropical countries. The Chaoborinæ include only four or five known genera, and only two of these, *Corethrella* and *Chaoborus*, occur in the tropics.

CORETHRELLA, Coq.

Among the distinctions of this genus from other Chaoborinæ one of the most obvious is the comparative shortness of vein R_1, which always ends much before the tip of R_2; there is some variation in this respect in the different species, but in the more typical forms of *Corethrella* R_1 is short and ends only slightly beyond the base of the radial fork; this is the condition in all the species noted below. Another important distinction of *Corethrella* is in the form of the clypeus, which is scarcely longer than broad and nearly bare, thus showing more resemblance to the Culicinæ than to other Chaoborinæ. The eyes also are larger and more approximate above. A synonym of *Corethrella* is *Ramcia*, Annandale ('Spolia Zeylanica,' vii. p. 187, 1911).

Corethrella inepta (Annandale).

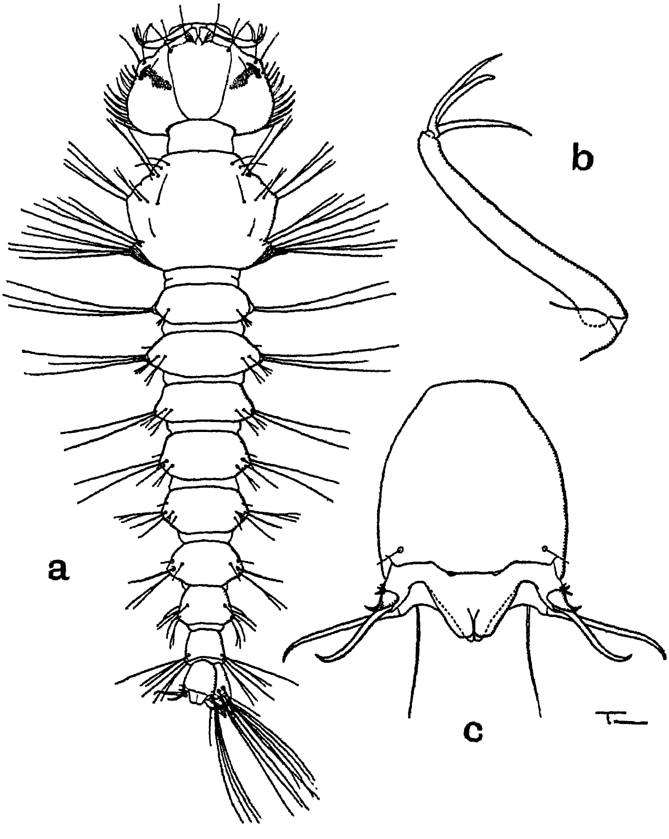
This is extremely similar in all structural details to the North American *C. brakeleyi*, Coq., and the West Indian *C. appendiculata*, Grabham, from which it differs in having only one dark area on the costal border and in the colour of the legs. Palpi apparently dark. Femora entirely pale. Front and middle tibiæ pale on about the basal two-thirds, dark apically; hind tibia pale on the basal four-fifths, dark at tip; front tibia shorter than the others, which are about equal in length. Front tarsi somewhat darkened, especially apically, with large but equal claws; middle and hind tarsi entirely pale, with small claws. Wings with costal fringe indistinctly darkened near base and at tip; a much more distinct dark area on and towards costa, including tips of *Sc* and R_1, and extending less distinctly across wing to tip of *An*.

Type ♂ in British Museum, from Diyatalawa, Ceylon (*Major MacDougall*).

Corethrella calathicola, sp. n. (Fig. 1.)

Head blackish, including clypeus. Palpi yellowish, middle two segments more or less darkened. Antennæ of the usual structure, plumes yellow. Thorax blackish, with rather ill-defined greyish mottling ; very minute pale hairs present along the lines of mesonotal bristles and on some parts of the bare ante-scutellar space. Scutellum yellowish in ♀. Abdomen dark, rather densely covered with yellow hair as usual. Coxite of hypopygium with one stout spine near base, and a row of four more slender spines, widely spaced. Front and middle femora and tibiæ almost entirely blackish or dark brown, with some yellow hair at tips ; hind femora blackish on about the basal two-thirds, yellowish on apical third ; hind tibiæ somewhat shorter than middle pair, with a

Fig. 1.



a, larva of *Corethrella calathicola*, sp. n., in dorsal view. b, antenna, further enlarged. c, siphon, further enlarged.

dark ring at base and another close to tip, broadly pale in middle. Tarsi all somewhat darkened, tips of segments yellowish. Front claws in ♂ large but unequal, middle and hind claws small. Wings with the hair on the basal third and the apical fringe more or less darkened (much more distinctly in ♀ than in ♂), with a more distinct dark area over tip of R_1 (broader in ♀, in which sex it can be traced across the wing to tip of Cu_2). Squama almost bare. Halteres with dark knob.

SINGAPORE; reared from larvæ found in pitcher-plants, 1926–7, 2♂ 2♀ (*Surg.-Com. D. H. C. Given*). SARAWAK: Kuching, 2 ♂ (*J. C. Moulton*).

Larva similar to that of *C. brakeleyi* and *C. inepta*, but differing in many details. Head much less pointed in front than in *C. inepta*, antennæ shorter, the three apical spines also relatively shorter. Thorax almost round; metathorax not wider than mesothorax, though with longer hairs, the lowermost hair set on a finger-like tubercle. Abdomen without specially developed lateral processes on the first two segments, which are similar in shape to the next four, though with longer hairs. No chitinous dorsal plates except on anal segment. Eighth segment with four lateral hairs, three of which are bifid near middle, the longest being simple. Ninth segment with two pairs of long bifid dorsal hairs set close together, another shorter simple hair dorso-laterally; ventral group consisting of only four long bifid hairs; lateral appendages (such as are described by Grabham in *C. appendiculata*) comb-like, but very pale, their precise form not determinable in the available material.

Pupa.—Similar to that of *C. inepta*. Segments 2–4 each with two lateral hairs; 5–7 with three, the most posterior of which is more slender than the other two; 8 with only one. Paddles at tip with one short pointed spine, and one longer spine (three times as long as the short one), with hooked tip; external bristle at three-fifths.

Corethrella picticollis, sp. n.

Palpi pale yellow, almost white in ♂. Thorax with bluish-grey mottling on a blackish ground, varying in appearance with incidence of light, but grey areas much more distinct than in *C. calathicola*, also somewhat differently arranged; pronotal lobes and eye-margins appearing silvery grey at some angles. Femora and tibiæ as in *C. calathicola*. Tarsi with the first four segments darkened at base (less extensively on hind legs), fifth segment entirely yellowish. Wings with the scales of fringe and hair of veins mostly yellow, dark at extreme base, and with a small blackish spot across costa, tip of R_1, and stem of radial fork; opposite to this is another small blackish area in posterior fringe and over tip of Cu_2. Squamal fringe incomplete. Knob of halteres dark.

NIGERIA: Lagos, 8. xi. 1909, 1 ♂ (*Dr. W. M. Graham*); ix. 1929, 2 ♀ (*C. B. Philip*).

Corethrella pallitarsis, sp. n.

Palpi yellowish. Thoracic mottling much as in *C. calathicola* (therefore less conspicuous than in *C. picticollis*), without bluish or silvery tinge. Femora and tibiæ as in *C. calathicola*, but tarsi unicolorous light brownish, not darkened at bases of segments. Wings with a band of grey hair (broader than in *C. picticollis*, but less clearly defined) extending from costa to hind margin at level of tip of R_1. Knob of halteres scarcely darkened.

NIGERIA: Lagos, 1. v. 1929, 2 ♀ (*C. B. Philip*).

Corethrella appendiculata, Grabh.

This closely resembles the three new species described above, especially *C. calathicola*, the most obvious difference being that the fine short hairs of the mesonotum are more numerous, more widely dispersed over the surface, and somewhat longer. Previous records are from Jamaica, Santo Domingo, and Panama; the British Museum possesses two specimens from Grenada, one reared from a tree-hole, one from a wild pine.

CHAOBORUS, Licht.

Dyar and Shannon have recently (Insec. Inscit. xii. p. 209, 1924) divided this genus into three subgenera, basing the division on the relative position of the bases of the fork-cells and the presence or absence of spots on the wings. Both these characters are in my opinion quite unimportant, but the three subgenera may nevertheless be recognized on other characters.

Subgenus *Chaoborus*, s. str.—Rather large species. Pulvilli always distinct, over half as long as claws. Venation: *Rs* long, not angled at base, and never with spur. Cu_2 running straight to the hind margin, without spur. *An* reaching slightly beyond level of *r–m*. Wings unspotted; legs not ringed.

This includes three European and four or five North American species; also the Chinese *C. cornfordi*, Theo.

Subgenus *Schadonophasma*, D. & S.—Similar to *Chaoborus*, s. str., but *An* longer, reaching well beyond level of *r–m*, and wings spotted.

This includes the North American *C. trivittatus*, Lw., and the European *C. nyblæi*, Zett.; this latter is not a synonym of *C. pallidus*, as I had supposed before examining the type, but is possibly the same as *C. trivittatus*.

Subgenus *Sayomyia*, Coq.—Size usually smaller than in the other subgenera. Pulvilli absent (except in *C. brasiliensis*, Theo., and *C. brevisector*, sp. n.). Venation: *Rs* shorter than in *Chaoborus*, s. str., angled at base, with a shorter or longer spur extending from the angle towards base of wing. Extreme tip of Cu_2 faint or absent; a long hairy spur extending forwards parallel with wing-margin, sometimes almost reaching tip of Cu_1. *An* reaching only slightly beyond base of cubital fork. Wing-fringe usually long.

This includes the five North and Central American species noted by Dyar and Shannon, the European *C. pallidus*, Fab., and the twelve species noted below. Some species agree with the sub-genotype in having markings on the wings and numerous spots or rings on the legs, but others lack these features.

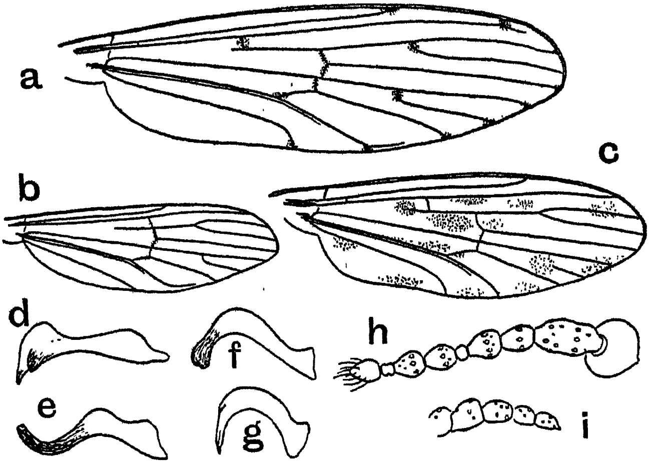
Chaoborus (*Sayomyia*) *brevisector*, sp. n. (Fig. 2, b.)

Head light brownish, including clypeus; antennæ and palpi darker. Flagellum of normal form, last two segments elongate, last noticeably longer than penultimate. Thorax with scutal stripes fused, dark brownish, pre-scutellar area equally dark; shoulders extensively yellowish; scutellum dark, lighter at base, no darker median line. Hair blackish. Abdomen light brownish, sides of tergites darkened at base. Legs uniformly light brownish; front legs longer than usual, the tibia as long as the abdomen; pulvilli present but small, less than half as long as claws. Wings (fig. 2, b) without definite markings, but with a slight dark seam over the cross-veins; hair all brownish, slightly darker on costa for some distance before tip. *Sc* ending above *r–m*; R_1 somewhat shortened, ending at about three-fourths of the length of R_2; *Rs* very short, almost vertical, and practically in line with basal section of R_{4+5} and cross-veins *r–m* and *m–cu*; a long spur, equalling and in line with R_{2+3}, extends backwards from point of contact of *Rs* and basal section of R_{4+5}; cell R_2 scarcely twice as long as its stem; Cu_2 with the usual long spur, reaching nearly to tip of Cu_1; *An* ending about opposite base of cubital fork. Squama fringed as usual. Halteres yellowish. Wing-length 2 mm.

Brazil: Manaos, iv. 1901, "on board S.S. 'Jerome,'" 1 ♀.

The venational peculiarities of this specimen might be considered sufficient to justify the erection of a new subgenus for it, but it may possibly be abnormal.

Fig. 2.



Chaoborus (*Sayomyia*) *asiaticus* (Giles). (Fig. 2, d.)

Clypeus darkened, almost as dark as palpi, and contrasting with the pale vertex; first antennal segment also darkened. Mesonotal stripes dark, but almost completely obscured in dry specimens (except when greasy) by the thick grey pollen which covers the scutum. Punctures at bases of mesonotal hairs usually somewhat darkened, especially in ♂. Scutellum with black median line. Posterior pronotum often somewhat darkened on upper half. Hypopygium with the parameres (fig. 2, d) rather short, flattened, enlarged apically, with a short downwardly projecting hook at tip. Legs uniformly pale, also the wing-hair. *Rs* rather long, with very short spur at basal angle. Knob of halteres somewhat darkened on one side.

This is the common species in India and Ceylon, and may also have a wider distribution, but several similar species have been confused; I now believe I was in error in recording *C. asiaticus* as a synonym of *C. manilensis*, Schin. The British Museum possesses males from Karnal, Punjab (*Barraud*); Calcutta (*Annandale*); Madhupur, Bengal, and Colombo, Ceylon (*Paiva*); also females from Pusa (*Sharma*) and Coimbatore (*Fletcher*).

Chaoborus (*Sayomyia*) *flavidulus*, sp. n. (Fig. 2, e.)

A small species with uniformly yellowish legs and wings, as in *C. asiaticus*, but head and thorax more uniformly pale yellow. Clypeus and first antennal segment pale yellowish, like the vertex, but palpi darkened. Thorax with scarcely any grey dusting; three scutal stripes faintly darkened, the middle stripe often with an ill-defined median brown line; median line of scutellum scarcely indicated. Hypopygium with parameres (fig. 2, e) longer than in *C. asiaticus*, not enlarged at tip nor pointed; apical half blackened and strongly curved, tip slightly bifid. Coxite and style as in *C. asiaticus*, former long and without lobe. Wings of ♂ narrower than in *C. asiaticus*; *Rs* often shorter, but with much longer spur at basal angle. No special darkening of any veins. Halteres entirely pale.

MALAY STATES: Kuala Lumpur, 1922–4, 2 ♂, 2 ♀ at light, including type (*H. M. Pendlebury*); 1915, 1 ♀ (*Dr. A. T. Stanton*). SIAM: Jalor Caves, 21. x. 1901, 3 ♂ (*H. C. Robinson* and *N. Annandale*). SARAWAK: Kuching, 31. vii. 1914, 1 ♂ in house (*J. C. Moulton*). I have previously recorded the Malayan specimens as *C. asiaticus*.

Chaoborus (*Sayomyia*) *annandalei*, sp. n. (Fig. 2, f, g.)

Externally similar to *C. flavidulus*, differing chiefly in the form of the parameres (fig. 2, f, g), which are slightly swollen and flattened apically (much less so than in *C. asiaticus*), ending in a longish point on one side. Mesonotum somewhat darkened in type, but clypeus, tori, and pleuræ pale.

TENASSERIM: Mudon, Amherst distr., 8. iii. 1908, 1 ♂ (*N. Annandale*).

Chaoborus (*Sayomyia*) *indicus* (Giles) *.

Clypeus and palpi black. Thorax as seen from in front largely greyish, with indications of three dark lines, in centre and at sides of median scutal stripe; as seen from side the mesonotum appears dark brownish, the lateral scutal stripes being continued to the front margin, leaving the side margin narrowly yellowish. Middle pair of stripes continued backwards to scutellum, which has a black median line. Legs whitish. Wings with veins R_{4+5}, *Cu*, and Cu_2 dark brown, clothed with blackish hair, otherwise pale. *Rs* rather short, with long spur at basal angle.

Apart from Giles' type ♀, from Seondara, N.W.P., India, the British Museum possesses 3 ♀ from Mt. Korinchi, Sumatra (*H. C. Robinson* and *C. B. Kloss*).

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* Journ. Trop. Med. vii. p. 49 (1905). This species has been omitted from catalogues and from the 'Zoological Record.'

Chaoborus (*Sayomyia*) *pallidipes*, Theo.

Thorax uniformly chocolate-brown above (more greyish when seen from in front); scutellum with a median black line; pleuræ lighter, but not strongly contrasted. Abdomen dark brown in both sexes. Hypopygium of ♂ with coxite stout, less than three times as long as broad, without lobe; style stout, black, broader at base; parameres moderately long, slender, twisted, bluntly pointed at tip; ninth tergite very prominent, reaching middle of coxite. Legs uniformly pale. Wings unmarked, none of the veins darkened. Wing-length about 3 mm.

Theobald's type was a female from Kampala, Uganda. The British Museum also possesses a male from Kerenge I., Lake Victoria, 14. i. 1919 (*Dr. G. D. H. Carpenter*), and a number of females from Tanganyika Territory, Eastern shore of Lake Victoria, 17. iii. 1926, "in great numbers in bungalow" (*Dr. J. F. Corson*).

Chaoborus (*Sayomyia*) *edulis*, sp. n.

Head brownish, proboscis and palpi black. Scape dark brown, antennal plume entirely pale yellowish. Thorax dull greyish brown without distinct markings, pleuræ scarcely lighter than dorsum. Abdomen dark brown, somewhat shining. Hypopygium with coxite just over three times as long as broad, without lobe; style rather slender and somewhat tapering; parameres extending back to two-fifths length of coxite, appearing tapering and sharply pointed in dorsal view, but in side-view they are seen to be enlarged apically, with a ventral excision near the pointed tip; ninth tergite not very prominent. Legs light brownish. Wings unmarked, no veins darkened; cell R_2 shorter than in the last two, scarcely twice as long as its stem. Wing-length about 2·5 mm.

Nyasaland : Lake Nyasa, x. 1915, 7 ♂ (*Dr. J. B. Davey*).

The specimens were labelled "Kungu" by the collector, presumably implying that they are the *kungu* of the natives of Lake Nyasa, first mentioned by Livingstone, and subsequently by Sharp in the 'Cambridge Natural History.' Sharp stated that the fly used for "kungu cake" was "believed to be a species of *Corethra*," but gave no authority for this belief. Dr. W. R. Lamborn informs the writer that the fly eaten by the natives is certainly a particular species, which breeds in the lake and at certain seasons flies over the water in dense clouds. It is prepared and cooked in various ways.

Chaoborus (*Sayomyia*) *fuscinervis*, sp. n.

Thorax chocolate-brown above, margin of scutum narrowly ochreous; scutellum with a black median line; pleuræ mostly pale ochreous, contrasting with mesonotum. Abdomen mostly whitish; some black pigment internally near sternal joints. Hypopygium of ♂ with coxite not unusually stout, quite four times as long as broad; style rather long, not blackened, and not broadened at base; parameres stouter and less twisted than in *C. pallidipes*, tips rounded; ninth tergite scarcely reaching one-fourth length of coxite. Legs uniformly pale. Wings unmarked, but veins R_{4+5}, Cu, and Cu_2 distinctly darkened throughout their whole length. *Rs* with a long spur from the basal angle; cell R_2 about 2·5 times as long as its stem. Wing-length about 3 mm.

Belgian Congo: Kasinga, Katanga, vi. 1925, 4 ♂ (*Dr. J. Schwetz*).

A female from Ututo, Uganda (*Dr. R. E. McConnell*), is possibly this species; it differs from the male in having the mesonotum pale, with four slightly darker stripes; the wings are similar.

Chaoborus (*Sayomyia*) *ceratopogones*, Theo.

Antennæ ringed with black and white; those of ♀ normal, with long verticils, the last two segments elongate. Palpi mainly dark brown, but the second segment white or yellowish. Thorax more or less mottled, but without small dark dots. Femora and tibiæ each with 6–9 narrow black rings; tarsi mainly dark, with pale rings. Wings with the costa largely pale, but with three dark areas, variable in width; other variable dark markings on many of the veins; all these markings are mainly due to the colour of the hair, and do not extend on to the membrane. *Rs* with moderately long spur at the basal angle; cell R_2 quite six times as long as its stem in ♀, about four times in ♂.

Theobald's type was from Gambia, but the species is widely distributed throughout tropical Africa. British Museum material is from the following localities:—Nigeria: Ere (*Dr. J. J. Simpson*); Lagos (*C. B. Philip*). Gold Coast: Accra (*Dr. J. W. S. Macfie*): Addah (*W. I. Braybrook*). Sierra Leone: Njala (*E. Hargreaves*). Uganda: S.W. Buddu (*Dr. S. A. Neave*). Kenya: Nairobi (*T. J. Anderson*); Marsabit (*Dr. J. R. H. Chell*). Nyasaland: Mt. Mlanje (*Dr. S. A. Neave*). Belgian Congo: Elisabethville (*Dr. J. Schwetz*). N.E. Rhodesia: Luangwa (*Dr. S. A. Neave*).

Chaoborus (*Sayomyia*) *microstictus*, sp. n. (Fig. 2, a.)

Head yellowish. Antennæ entirely yellowish except for the last segment, which is black; all flagellar segments unusually short, the last two not longer than the others, terminal segment (thirteenth) somewhat stouter and more pubescent; verticils shorter than usual, the whole antenna resembling that of the Chironomid genus *Tanypus*. Palpi mainly dark brown, but second segment largely yellowish. Thorax pale whitish yellow; pronotal lobes dark brown; four brownish-yellow stripes on scutum. Abdomen yellowish. Legs whitish; femora and tibiæ without dark rings, even at the tip, but with numerous minute brown dots at the bases of the hairs; tarsi with tips of segments darkened. Wings (fig. 2, a) whitish, with small black dots at the bases of the three forks, at the base of *Rs*, over the cross-veins, and at tips of all veins except R_1 and R_3. (In both specimens the wings are mainly denuded, but the hair was apparently all pale.) A small adventitious cross-vein (covered by a black dot) connects R_1 with the costa near its tip, the actual tip of R_1 being faint. *Rs* longer than in most species of this subgenus, with short spur at basal angle. Cell R_2 less than twice as long as its stem, its base level with or slightly beyond that of cell M_1. M_2 angled and slightly spurred at the base. Spur of Cu_2 shorter than in most species of the subgenus. Halteres chalk-white. Wing-length 3·5 mm.

S. AFRICA: Orange Free State, Harrismith, iii. 1927, 2 ♀ (*R. E. Turner*).

This is evidently allied to the North American *C. punctipennis*, which has quite similar wing-markings. Some specimens of *C. punctipennis* even show a similar formation of the tip of vein R_1.

Chaoborus (*Sayomyia*) *queenslandensis*, Theo.

This is very closely allied to the African *C. ceratopogones*, differing chiefly in having only two dark areas on the costa, the outer of which is distinguishable by transmitted light as a dark cloud on the membrane; the upper fork-cell is somewhat shorter.

Chaoborus (*Sayomyia*) *brasiliensis* (Theo.).

Similar to *C. ceratopogones* and *C. queenslandensis*, but dark wing-markings chiefly affecting the membrane, and present only on the wing-field, not reaching the costa; there is a cloud above the end of *An*, and three clouds, more or less joined, over the stems of the radial and median forks and over the end of Cu_2. Distinct pulvilli are present, about half as long as the claws, a character which distinguishes this species from all other members of the subgenus known to me. Venation normal for the subgenus ; spurs of *Rs* and Cu_2 long ; base of cell R_2 usually distal to that of cell M_1.

Apart from Theobald's damaged type from Brazil, I have seen specimens from Trinidad, collected by Drs. J. R. Dickson and C. L. Withycombe ; I also took a series at La Plata, Argentine, i. 1927, obviously conspecific. In view of the wide range it is most probable that *C. festivus*, Dyar and Shannon (Panama), and *C. elnoræ*, Shannon, and Del Ponte (Northern Argentina), are synonymous.

Subgenus NEOCHAOBORUS, nov.

Small species, generally resembling *Sayomyia*, but antennæ and palpi reduced, at least in ♀. Pulvilli absent, as in *Sayomyia*. Venation : *Rs* rather short and spurred, as in *Sayomyia*, but vein M_2 disconnected at base, and Cu_2 not distinctly spurred.

Chaoborus (*Neochaoborus*) *anomalus*, sp. n.
(Fig. 2, c, h, & i.)

♀. *Head* yellowish. Antennæ (fig. 2, h) with the scape yellowish, flagellum more or less darkened. Only eight or nine flagellar segments are present, of which the first is nearly twice as long as broad, second and third rather shortly oval, fourth much smaller and almost globular (sometimes almost crowded out), fifth and sixth similar to third, seventh variable, sometimes small like fourth, sometimes more or less divided, a small ninth segment sometimes present. Verticils short, last segment with short pubescence. Clypeus yellowish. Palpi (fig. 2, i) very short, segments scarcely longer than broad, but rather variable, third and fourth sometimes fused. *Thorax* with light ochreous ground-colour. Four dark greyish-brown scutal stripes, the anterior ends and inner margins of which are more or less darkened ; numerous dark brown dots, one at the base of each hair, on shoulders and between stripes. At the posterior end of the middle pair of stripes, as in many species of the subgenus *Sayomyia*, is a tuft of erect narrow scales. Pleuræ with two irregular and interrupted narrow dark longitudinal stripes. *Abdomen* ochreous, lateral margins of tergites black ; hairs towards sides set in dark dots. *Legs* pale ochreous ; each femur with a row of six to eight large black dots on anterior surface, not forming complete rings ; each tibia with six or seven complete narrow black rings; first four tarsal segments of all legs black at tip, first segment also with a black ring before middle. *Wings* (fig. 2, c) with the hair of costa and veins all pale, but with dark markings on the membrane, due to patches of dark microtrichia (hence visible by reflected but not by transmitted light). Of the dark patches one occurs over the spur of *Rs*, one in the outer end of the upper basal cell, one over R_{2+3}, one over the middle of R_2, one in the base of cell R_3, one at the base of vein M_2, and three or four along the hind margin. Tip of vein R_1 almost twice as far from R_2 as the latter is from R_3; *Rs* moderately long, with a short spur at the base angle; cell R_2 only 1·5 times as long as its stem; vein M_2 in all specimens broadly disconnected at the base; spur of Cu_2 much shorter and less distinct than usual, bearing few hairs. *An* ending about opposite base of cubital fork. Posterior fringe long, fully as long as greatest breadth of anal cell. Halteres whitish. Wing-length 2·7 mm.

UGANDA: Old Entebbe, 7. xii. 1928 & 16. vi. 1929, 11 ♀ (including type) (*G. L. R. Hancock*). GOLD COAST: Accra, in laboratory, iii. 1920, 1 ♀ (*Dr. J. W. S. Macfie*).

On account of the reduction of the antennæ and palpi and the interrupted vein M_2 it might be thought desirable to place this species in a separate genus. However, in most of its other characters it shows obvious affinity with species of the subgenus *Sayomyia*, and I therefore prefer to retain it in *Chaoborus* pending the discovery of the male and larva. The degeneration of the antennal flagellum is unique in this family, and is of special interest as foreshadowing the condition of the antenna in female Chironomidæ.

PROMOCHLONYX, gen. nov.

Differs from *Mochlonyx*, Loew, as follows:—Pleuræ almost bare. Each tibia with a single slender spur, about as long as tibial diameter.

Genotype, *Corethra australiensis*, Ferguson.

The presence of tibial spurs has not previously been noted in any Culicid, and seems a sufficient generic distinction from *Mochlonyx*. I am indebted to Mr. Kershaw, of the Melbourne Museum, for the loan of the types.

CRYOPHILA, gen. nov. (Bergroth MS.).

Differs from *Mochlonyx*, Loew, as follows:—Metapleura (hypopleura) with a tuft of hairs. Tibial spurs present—one on front, two on middle, and two on hind tibia. First segment of each tarsus about half as long as second. Claws in both sexes all moderately long, equal and simple. Larva (to be described by Montschadsky) intermediate between *Mochlonyx* and *Chaoborus*.

Genotype, *Mochlonyx lapponicus*, Martini.

LV.—*Two notable new Lamellicorn Beetles from Indo-China.* By GILBERT J. ARROW, F.Z.S., F.E.S.

[Plate XIV.]

THE two species of Coleoptera here described, one of them constituting a new genus, have been recently acquired by the British Museum from French Indo-China, where they were taken by Messieurs Jeanvoine and de Cooman. I am indebted to Monsieur J. Clermont for submitting them to me.

RHADINOLONTHA, gen. nov. (subfamily *Melolonthinæ*).

Corpus angustum, omnino pubescens, prothorace brevi, angulis posticis nullis, elytris angustissimis, abdomen haud tegentibus, hoc laxe articulato; pedibus 4 anterioribus brevibus, tibiis anticis tridentatis, posticis longioribus, tarsis omnibus brevibus, unguibus subtus medio minute dentatis; antennis 10-articulatis, clava breviter 7-lamellata.

Rhadinolontha mimetica, sp. n. (Pl. XIV. figs. 1 & 2.)

Nigra, longe hirta, capitis, pronoti parte antica, abdominisque supra capillis nigris, hujus segmentibus albomarginatis, pectoris corporisque medio capillis fulvis vestitis; elytris flavo-brunneis, nitidis, breviter nigro-setosis.

Long. 19–22 mm.; lat. 7–8 mm.

TONKIN: Hoa Binh (*A. de Cooman*); Chapa (*Jeanvoine*).

The insect here described constitutes a new genus of Melolonthini not very distantly related to the typical genus *Melolontha*, but remarkable for its slender, narrow-waisted form, reduced elytra, and uncovered, loosely-jointed abdomen, the whole aspect being strikingly bee-like. This is due especially to the thick hair upon the body, black in front and behind and yellow in the middle region, the white rings upon the abdomen, and the appearance of membranous wings produced by the light brown shining elytra, tapering behind and much shorter and narrower than the abdomen. The fine black setæ with which the surface of the elytra bristles increase the illusion of translucence.

With the exception of the elytra the upper surface is finely rugose or granular and opaque. The clypeus is short and evenly rounded, the pronotum rounded at the sides, with scarcely perceptible front angles, no hind angles, and almost straight basal margin. The pygidium is rather large and convex, and in the male its apex is a little produced. There is no mesosternal process, but the prosternum is prominent behind the coxæ. The legs are rather slender, the front tibia with the terminal tooth straight and two very minute but sharp lateral teeth, the hind tibia much longer than the rest and very little dilated at the end. The club of the antenna is very short, scarcely differing in the two sexes, and consists of seven joints, the first shorter than the rest. The tarsi are very short, but a little longer in the male. The most conspicuous difference between the sexes is in the shape of the abdomen, which is hollowed beneath in the male, with the fifth sternite short.

The appearance of the insect is somewhat that of Scoliidæ of the genus *Dielis*, and M. de Cooman informs me that he found it upon bushes in flower, so that its habits appear to be similar to those of the insects it resembles.

Trichogomphus robustus, sp. n. (subfamily *Dynastinæ*). (Pl. XIV. figs. 3 & 4.)

Niger, nitidus, elytris corporeque subtus plerumque piceis, hoc et pedibus capillis rufis vestitis; sat late ovalis, pedibus robustis, pronoto lato, antice valde augustato, angulis anticis acutis, scutello rugoso, elytris lævibus, vix perspicue punctatis, stria suturali subobsoleta; pygidii lateribus subtiliter rugosis, medio inæqualiter haud fortiter punctato:

♂, capite cornu curvato acuminato, postice unidentato, armato, pronoti medio excavato, lateribus antrorsum productis, processu late truncato et subtus acuminato:

♀, capite medio minute tuberculato, pronoto postice fortiter punctato, antice rugoso et medio leviter excavato.

Long. 34–44 mm.; lat. 20–25 mm.

TONKIN: Chapa. S. CHINA: Fo-kien.

Taken in August by M. Jeanvoine, this species is of shorter and stouter build than its congeners, and has markedly shorter and broader posterior tibiæ. These have a strong projecting external ridge in the middle and are greatly dilated at the extremity, where the middle pair are bilobed externally. The elytra are very smooth, but not very shining, the punctures being very few and minute. Each elytron has a feeble sutural stria, which may be effaced behind. The base of the pronotum is very gently curved, but not lobed in the middle, and the hind angles are almost right angles. The scutellum is rather closely rugose. In the male the head bears a long, pointed and rather compressed horn, with a tooth behind before the tip, and the sides of the pronotum are produced forwards as broad, almost vertical, and parallel lobes, truncate in front, with the lower angle sharper than the upper. The anterior half of the pronotum is abruptly narrowed, the lateral margins being angulate in the middle and concave in front. The sides and base of the pronotum and the inner terminal part of the lateral lobes are rugosely punctured.

In the female the head is closely rugose, with a small but sharp-pointed tubercle in the middle, the pronotum is coarsely rugose upon the anterior half and irregularly punctured upon the posterior half, the anterior half being hollowed in the middle, with a blunt tubercle in the middle of the front margin.

There is a small male in the Museum collection, labelled only with the locality "Fo-kien," which I believe to belong also to the species. In this the cephalic horn is short and without trace of a posterior tooth, the prothoracic excavation is confined to the anterior half of the thorax, instead of extending to the base as in the large specimen, and the lateral lobes are represented only by two short prominences on each side of the cavity.

EXPLANATION OF PLATE XIV.

Fig. 1. *Rhadinolontha mimetica*, sp. n., male.
Fig. 2. Ditto, female.
Fig. 3. *Trichogomphus robustus*, sp. n., male.
Fig. 4. Ditto, female.
Natural size.

LVI.—*Second Species of the Genus* Marellia, *Uv., Semi-aquatic Grasshoppers from S. America.* By B. P. Uvarov.

I have described recently (Ann. & Mag. Nat. Hist. ser. 10 vol. iv. 1929, p. 539) a curious South American grasshopper, *Marellia remipes*, which I suggested to be semi-aquatic in habits because of the peculiar structure of its hind legs. Now I have before me another species of the same genus taken in the British Guiana, and the circumstances under which it was taken confirm my suggestion. Indeed, the specimen has been taken on leaves of a water-lily in a creek, and an insect living in such a habitat must swim, at least occasionally.

It is to be hoped that Mr. L. D. Cleare, Jr., who made this interesting discovery, will be able to obtain further specimens as well as to make observations on the habits of the insect.

Marellia clearei, sp. n.

♀. Smaller than *M. remipes*, Uv., and brachypterous.

Antennæ not reaching beyond the prozona of the pronotum, incrassate towards the apex. Face less strongly oblique than in the genotype, seen in profile slightly convex. Lateral facial keels very obtuse, but perceptible (entirely obsolete in *M. remipes*). Vertex moderately prominent in front; its surface distinctly concave, with minute punctures; margins well raised, subacute. Occiput with a faint median carinula, very slightly rugulose.

Pronotum scarcely narrowed in front. Upper surface quite flat; puncturation less dense and not so coarse as in *M. remipes*. Anterior margin truncate, very slightly concave in the middle. Posterior margin very obtusely angulate, rounded. Median carina represented only by a very fine line on the metazona. Lateral lobes relatively shorter and higher than in *M. remipes*; lower margin more convex in the middle.

Elytra extending to the middle of the abdomen, strongly narrowed behind, with pointed apices. Wings considerably shorter than the elytra.

Hind knee-lobes acute triangular, not with long spines as in *M. remipes*. Hind tibiæ as in that species. First joint of hind tarsus with broadly expanded sides; second joint normal; third joint with the expanded upper margin.

Subgenital plate trough-like, compressed laterally, carinated along the middle, the carina finely sulcate, the apex triangularly excised and somewhat decurved. Supra-anal plate, cerci, and ovipositor as in the genotype.

General coloration pale brownish olivaceous, the upper side being of darker brown shade. Hind femur with a few blackish dots along the lower external carina.

Length of body 24; pronotum 4·5; elytra 9·5; hind femur 12·5 mm.

Described from a single female collected at Barabara Rest House, N.W. District, British Guiana, 9. vii. 1929, "on leaves of lily in creek" (*L. D. Cleare, Jr.*).

LVII.—*Notes on the Cephalopoda.*—No. 13. *The Position and Affinities of* Palæoctopus. By G. C Robson, M.A.

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The highly interesting fossil form known as *Palæoctopus newboldi*, Woodward, was obtained from the Cretaceous of the Lebanon in 1846, and was described by Woodward (1896, p. 229). Its peculiarities and affinities have been discussed by Dollo (1912), Abel (1916), and Naef (1923). The only definite pronouncement of recent years as to its exact status is that of Naef (*l. c.* p. 672), who created for it a separate suborder (Palæoctopoda), pointing out that it seems to occupy an intermediate position between the Cirromorpha and Incirrata. Certain points in this fossil have been overlooked by the various authors, and it is necessary to give a redescription of it.

The single specimen, which has been badly damaged at, at least, one critical point in an attempt to develop part of it, is in a slab of limestone, and measures about 145 mm. in length. From a consideration of the deposit itself there seems to be little doubt that it was laid down in inshore waters of about 10 fathoms depth. The animal has eight arms, which seem to be free of any web. I could distinguish no definite trace of the latter, though Woodward thought that it was possible to do so. Though Woodward liberally endowed his drawing with suckers, these are really only apparent as such on two out of the eight arms, where they are in profile. They have every appearance of having been uniserial, though they may have been widely alternating. Towards the extremity of one arm, where the cups are very clearly seen, they are clear of the edge of the arm and seem to have been pedunculate. Towards the oral end of the arm they lose this appearance and are seen close to the surface of the arm. This is, of course, a very important feature, as pedunculate suckers, an essentially Decapod feature, are only found in some of the admittedly archaic Vampyromorpha among the Octopods. The pedunculate appearance may be due to some disturbance which dragged the suckers away from the arms ; but this is really not very likely. In dealing with a highly critical specimen of this kind, and in view of Woodward's silence on the subject, I feel that one should have exceptionally strong reasons for asserting that the suckers are pedunculate. I base my assertion on the fact that at the distal end of the arm in question there is a very distinct area of matrix between the edge of the arm and the cup of the sucker. This could only be produced if the latter was standing well above the oral surface of the arm. I do not see how a sessile sucker, even if prominent, could have produced this effect, as such suckers are broadly adherent to the oral surface. It is, however, important to notice that at the adoral end of the arm the suckers have the appearance of being sessile, and a similar disposition is seen on the next arm. We thus seem to have in *Palæoctopus* a condition comparable to that noted by Joubin (1929, p. 387) in the Vampyromorph genus *Retroteuthis*, in which the adoral suckers are sessile and the distal ones pedunculate. Dr. L. F. Spath, who examined the specimen with me, has allowed me to say that he concurs with me in this view. I would like to point out that the suckers, even at the oral end of the arm, stand up with their main bulk well above the surface, an unusual condition for those of an Octopod.

There seem to be indications of keels on some of the arms. I could find no trace of cirrhi. The head is very narrow and is clearly demarcated from the body ; the eyes, as far as one can judge, are little prominent, and the body is saccular and rounded apically. Abel (1916, p. 177) compares it with that of a young *Cranchia*. There is a pair of subterminal triangular fins under half the width of the body. Running round the apex and closely applied to the fins is a very strongly marked semicircular thickening with more or less parallel sides terminating just beyond the distal edge of the fins on each side. This was ignored by Woodward, who doubtless considered that it was the effect of the flattening of the edge of the body. Owing (1) to the distinct and clearly demarcated way in which it is set-off, (2) its shape, and (3) the fact that it is only continued a little beyond the arms, I believe that this is the indication of the shell-vestige, which in many Cirromorphs is of a half-hoop shape *, as in this case. Dr. Spath, who kindly looked at the specimen for me, also informs me that this structure has the appearance of having been originally represented by a solid and fairly hard body by the way in which it is mineralized. This is a less debatable feature than the suckers, and I believe that the interpretation offered here may be safely accepted.

Woodward stated that he could locate the mandibles, funnel, and ink-sac. The indications of the first are highly uncertain, and I think he was in error as to them. The oval depression in the centre of the body, which he assumed to be the cavity left by the solid mass of the contents of the ink-sac, is more likely to be correctly interpreted, as it more or less occupies the position of the sac in a modern *Octopus*. The depression is *diagonally* placed, which is very unusual, but may be due to the obvious distortion of the specimen. I do not understand why the cavity of the ink-sac is preserved and not that of the heart and kidneys, unless it be that the substance of the " ink " was more resistant. Emerging from the inferior end of the depression is a meandering narrow depression, which I think is the duct of the sac. Dr. Spath tells me that the cavity is unusually deep and clearly cut ; but it is in general comparable with the similar cavity representing the ink-sac seen in a specimen of *Geoteuthis agassizii* from the U. Lias of Curcy.

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* According to Joubin (1920) the shell-rudiment in *Melanoteuthis* is somewhat of this shape.

We may summarize the important features of this specimen as follows:—

A. Cirromorph characters:

1. The fins.
2. The form of the shell-vestige.
3. Uniserial suckers.

B. Vampyromorph characters:

1. Pedunculate suckers on part of the arms (?).
2. Ink-sac present.
3. Uniserial suckers.
4. Fins.

C. Incirrate characters:

1. Absence of cirrhi.
2. Uniserial suckers. (Eledonellidæ, *Eledone.*)
3. Reduction of web. (Eledonellidæ &c.)
4. Ink-sac present.
5. General shape of head and body.
6. Head clearly demarcated from body.
7. Shallow-water habitat.

If we evaluate the arrangement of the suckers as found in all three classes it will be seen that at present there is a marked preponderance of Incirrate characters. For the time being, however, we would do best to treat *Palæoctopus* as representing a separate suborder, as the Incirrate characters seem, on the whole, to be rather less definite, if more numerous, than those characteristic of the other groups. Moreover, although C 3 and 6 are characters not usually found in the Cirromorpha they are found together in the somewhat enigmatic Cirroteuthid *Frœkenia clara*, which is very *Octopus*-like in build. I think it cannot be sufficiently stressed that the Vampyromorph characters outnumber the Cirromorph, and that, if the view taken here be ultimately found correct, *Palæoctopus* would seem to be a link between the archaic forms and the Incirrata.

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The Reptilia and Amphibia of the Malay Peninsula. By Malcolm A. Smith, F.Z.S. (Bulletin of the Raffles Museum, Singapore, Straits Settlements, no. 3, April 1930.) Price $1.00, or 2*s*. 6*d*.

Since 1912, the year in which Dr. G. A. Boulenger published a volume on the Reptilia and Batrachia of the Malay Peninsula, a number of new species have come to light and many new records of previously known species have been made; the present work, by one who has already published a number of papers on the herpetology of this area and of Indo-China in general, is supplementary to Boulenger's volume, giving descriptions of all forms which have been added to the fauna of the peninsula since the date of the earlier volume, discussing certain doubtful species, and incorporating recent changes in nomenclature. Keys are given, which, of course, include the species in Boulenger's work even though these are not here redescribed in full. Dr. Smith draws attention to an interesting zoogeographical problem—the unexplained discontinuity in the distribution of certain species which are found in the northern part of the peninsula and again in the Malay Archipelago, but not in the southern part of the peninsula; he also mentions certain other questions which are in need of investigation.

Dr. Smith appears to have carried out this task in a very complete and thorough manner; that it needed doing is evident from the size of the present work (150 pp.), and from the list of recent literature—more than forty papers, fully half by Dr. Smith himself—which has had to be incorporated. We wish, however, that he had followed the International Rules of Nomenclature, instead of perpetuating (or actually resuscitating) such barbaric mistranscriptions and mistransliterations as *Crocodylus*, *Agkistrodon*, *Kolpophis*, *Aplopeltura*, etc. The international code gives ample authority for correcting such eyesores; indeed, *Agkistrodon* is actually there held up to scorn as a horrid example of "how not to do it"!

Histological and Illustrative Methods for Entomologists. By H. Eltringham, D.Sc., F.R.S., etc. With a Chapter on mounting whole Insects by H. Britten, F.E.S. Oxford, at the Clarendon Press, 1930. Price 7*s*. 6*d*.

Within the compass of 140 pages Dr. Eltringham has produced a book which will be of the greatest value not only to entomologists but also to all zoological laboratories. Histologically, as the Introduction points out, insects are difficult to deal with, both on account of their small size and also, and more especially, because of the presence of chitin; and the present work is said to be designed for those who have not had the advantage of a laboratory training.

But there must be many departments of general zoology, and even of entomology, where, for example, section-cutting, the primary engine of morphological investigation, is never applied to insects, and possibly where the appropriate methods are scarcely known. Several modes of softening chitin are given, but it appears that there is still no method which will give a satisfactory result without at the same time destroying the structure of the softer tissues included in the material. Methods of double and triple embedding have therefore frequently to be resorted to, and these, as well as the ordinary single embedding process, are fully described. On every page we find evidence of the practised hand of the master in the numerous hints, the useful and inexpensive "tips," which are the outcome of long experience; and the same applies to the chapter on making preparations of small whole insects by Mr. H. Britten. Since "the entomologist, like other scientific workers, contributes to the sum of knowledge, first by making his researches, and then by imparting the results to his fellow-investigators," there are chapters on making drawings, on colouring lantern-slides and photographs, and on making models; these, no less than much of the histological chapters, will be as useful to zoologists in general, especially invertebrate zoologists, as to entomologists. To them, as well as to geneticists, cytologists, and all who use insects in their studies, we warmly commend Dr. Eltringham's book.

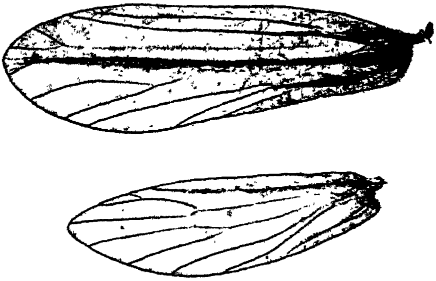
Animal Ecology and Evolution. By CHARLES ELTON.
Oxford, at the Clarendon Press, 1930. Price 4*s*. 6*d*.

MR. ELTON here puts forth, in a small and well-printed book of 96 pages, the substance of three lectures delivered in the University of London in the autumn of 1929 on the subjects of "The Regulation of Numbers," "The Significance of Migration," and "The Real Life of Animals," respectively. In his introductory pages he alludes to "the present remarkably chaotic state of the largely uncoordinated data that animal ecologists have collected"; and later he speaks of "the rapidly rising midden-heap of undigested ecological data," the very scattered literature (which includes, for example, the 'Daily Express' and the 'Bulletin of the U.S. Army Signal Service'), the splitting up of ecology into innumerable tiny subjects which often work in complete isolation, and the absence of any general index or even of any general method of indexing ecological literature. One of the crying wants, therefore, is some series of coordinating principles, some general points of view, to give a direction to work that has hitherto been for the most part merely the gathering of unrelated facts ("a mountain of undigested scientific débris"), and which, for want of such principles, has neglected almost completely some important sides of the subject. There can be no more important side of ecology, from the practical and economic point of view, than that which deals with the numbers of animals and the means by which these numbers are regulated; the whole struggle against pests and parasites is involved. Yet we do not know "the density of numbers of the population of more than a handful of the commonest birds in England, and birds have perhaps been studied by naturalists more than any other group of animals." It is the author's view that the coordinating principles which are so badly needed in the science of ecology are to be sought in evolution; questions of adaptation take up a considerable proportion of the available space, and there is also much on the topics of natural selection, the selection of the environment by the animal, the establishment and spread of mutations, tradition in evolution, etc. It is a little difficult to understand who the author is "getting at" in his repeated allusions to the "real life" of animals as opposed to "the life they live" (or "the constricted and difficult life they attempt to live") "in zoological text-books." Text-books of comparative anatomy do not attempt an account of the life of animals, and such books as professedly do this are naturally dependent on the chaotic and uncoordinated mass (the "midden-heap") which, according to Mr. Elton, at present constitutes the material of his science. Mr. Elton is an enthusiast, and in consequence what he writes is fresh and interesting—all the more interesting that there are statements and views that one would like to have an opportunity of arguing with him. We hope that the present small book will send such of his readers as do not know it to his larger work on Animal Ecology, published a few years ago, and wish him all success in his task of bringing order into the branch of science to which he is devoting himself.

MISCELLANEOUS.

A Nomenclatural Correction. By H. A. Baylis, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

In my paper on "Four new Trichostrongylid Nematodes from Queensland," recently published in this Journal (ser. 10, vol. vi. July 1930, pp. 1-18), I made use of the name *Nicollia* for a new genus of Nematodes. Dr. Albert Hassall has very kindly drawn my attention to the fact that this name was used by Nuttall in 1908 for a genus of Protozoa. It seems also to have been used independently for another genus of Protozoa by Kritschewsky in 1922. The name of my new genus must therefore be changed, and I propose to substitute for it the name *Nicollina*. The name of the genotype will thus become *Nicollina tachyglossi*, and that of the second species *Nicollina echidnæ*.



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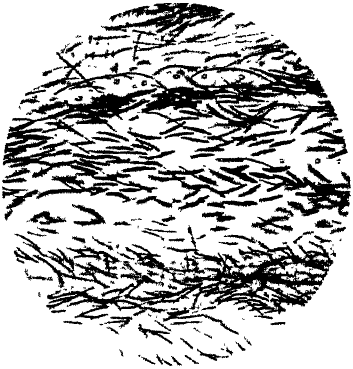

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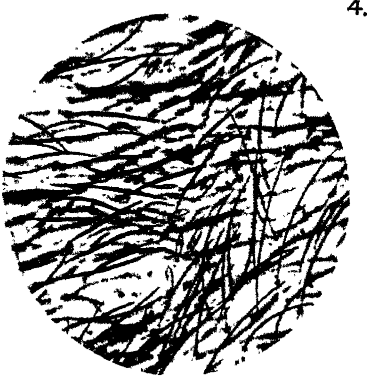

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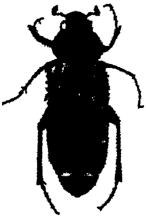

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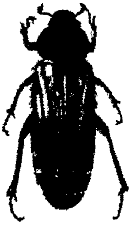

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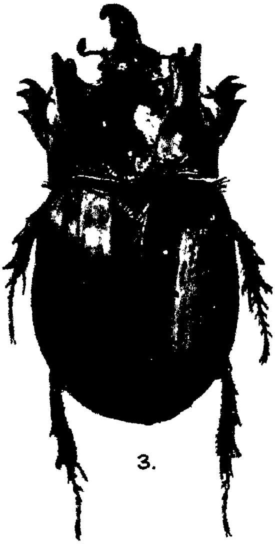

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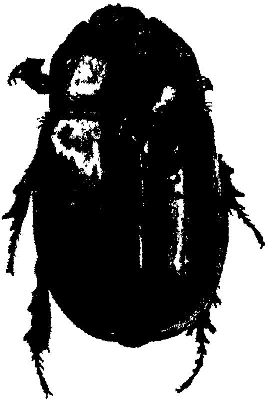

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BEETLES FROM INDO-CHINA.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 35. NOVEMBER 1930.

LVIII.—*New* Curculionidæ, *with Notes on Synonymy.*

By Sir GUY MARSHALL, C.M.G., F.R.S.

Subfamily *BRACHYDERINÆ.*

ÆDOPHRONUS, Schh., 1847.

Mimaulodes, Marshall, Ann. & Mag. Nat. Hist. (9) i. 1918, p. 5 (n. syn.).

Having recently been able to examine the type of *Ædophronus setosus*, Fhs., 1871, I find the species placed by me in *Mimaulodes* are certainly congeneric with it; *M. fimbriatus*, Mshl., 1918, and *M. hirtulus*, Mshl., 1927, must therefore be transferred to *Ædophronus.*

Ædophronus pretoriensis, sp. n.

Derm black or piceous, with dense light brown scaling having a brassy or coppery reflection; the prothorax with an ill-defined broad darker median stripe and a sharply defined whitish stripe on the extreme lateral margin; the elytra usually almost unicolorous above, but sometimes variegated with darker and paler patches, or occasionally with a whitish stripe on intervals 3 and 5, and always with a whitish stripe on interval 8 (continuous with that on the prothorax) to beyond the middle, below which the scaling is of a much darker brown than on the dorsum and hardly metallic.

Head very convex, with the median stria not reaching the vertex and the anterior stria straight; the infra-ocular margin broader than the apex of the scape and bearing a projecting agglomeration of scales; the setæ short, broad, and subrecumbent. *Rostrum* much shorter than its basal width, rapidly narrowed in front, almost straight at the sides, quite flat dorsally, without any median ridge or transverse impression, and the marginal carina of the epistome obsolescent. *Prothorax* twice as broad as long, strongly rounded at the sides, widest at the middle; the base gently arcuate and the apex only slightly narrower and shallowly sinuate; the dorsum even, strongly convex transversely, flat longitudinally, and with a trace of an abbreviated median stria; the dorsal setæ short, broad, truncate, and subrecumbent; the lateral setæ long, erect, cylindrical, and pointed, forming two often irregular rows, those in the outer row longer, about as long as the scape. *Elytra* broadly ovate, widest about the middle, obtusely rounded behind, jointly and shallowly sinuate at the base, with shallow, distinctly punctate striæ; the intervals flat, each with a row of erect setæ, those towards the sides and apex being similar to the lateral ones on the prothorax, the discal ones being shorter, compressed, and truncate; the scales dense, but not overlapping, like mosaic. *Legs* with metallic mosaic-like scales throughout and short pale subrecumbent setæ; the front tibiæ with an apical row of three or four spines and two on the external edge.

Length 2·6–3·0 mm., breadth 1·5–1·7 mm.

TRANSVAAL: Edendale, Pretoria, 6 specimens, 27. xi. 1927 (*H. K. Munro*).

Allied to the genotype, *Æ. setosus*, Fhs., the original description of which may be amplified as follows:—

Head less convex; infra-ocular margin narrower than the apex of the scape and not projecting; the median stria reaching the vertex and the anterior stria straight. *Rostrum* with a very shallow broad transverse impression on the apical half and with no median carina; marginal carina of epistome distinct. *Prothorax* less transverse (4 : 6·6), with the front margin subtruncate; the lateral setæ numerous, cylindrical, comparatively short, about half the length of the scape. *Elytra* with finer punctures; the erect setæ much shorter, more numerous, subcylindrical, and truncate. *Legs* with the corbels of the hind tibiæ very narrowly enclosed.

Subfamily *Otiorrhynchinæ.*

Rhyncogonus navicularis, sp. n.

♂ ♀. Derm rather dull black, sometimes with a slight bluish or brassy tinge; the prothorax bare on the disk, the pleuræ with long dense recumbent fulvous hairs, which turn to whitish where they encroach on the lateral margins of the dorsum; the scutellum with dense whitish hairs; the elytra with a stripe of whitish hairs on the edge of the dorsum running from the base and gradually narrowing to a point at about one-fourth from the apex, the hairs on the inflexed margins from the base to the hind coxæ fulvous or yellowish; the sternum rather thinly clothed laterally with whitish or yellowish hairs, and the ventrites each with a patch of whitish hairs in the basal angles.

Head with coarse, longitudinally confluent punctures on the forehead, and finer, obliquely confluent punctures behind the eyes; the forehead with a small elongate median fovea and set with sparse subrecumbent light and dark setæ. *Rostrum* slightly narrowed from the base to the middle and then dilated again, the width at the genæ being equal to that at the base; the dorsum broad and almost flat, not very steeply declivous in front, without any median carina or sulcus, but with coarse shallow longitudinally-confluent punctures and a few short transverse setæ, the apical area with much finer separated punctures. *Antennæ* with the scape almost straight, with small shallow oblique punctures containing short subrecumbent pale setæ; the funicle with all the joints much longer than broad, their relative lengths in order: 2, 1, 3, (4, 5, 6, 7); the club with joint 1 longer than 7 of the funicle. *Prothorax* only slightly broader than long, almost parallel-sided from the base to beyond the middle and thence gently rounded to the apex without any constriction, the apex being narrower than the base (7 : 9); the dorsum gently convex transversely and flat longitudinally, set throughout with coarse shallow confluent punctures, each bearing a minute recumbent seta on the disk; the punctures much finer laterally, but mostly concealed by the hairs. *Elytra* shallowly sinuate at the base, the apices almost jointly rounded in ♀, separated and very slightly upturned in ♂; the dorsal area in ♀ separated from the inflexed margin in the basal half by a sharp carina, which is entirely lacking in ♂; the dorsal outline of ♂ almost flat from base to apex, but with a more or less distinct indentation behind the middle, giving the body a boat-shaped appearance; the outline of ♀ rising from the base to one-fourth and then sloping very gradually in a straight line to the apex; the dorsum in ♂ closely set with asperate or rasp-like irregular granules, which are mostly replaced by shallow punctures in ♀ and also in some ♂ ♂; the lateral margins behind the hind coxæ with two or three very shallow punctate striæ; the hairs in the dorso-lateral stripe becoming gradually shorter and finer behind, the lateral margins in the apical half with a thin fringe of long erect setæ. *Legs* with fine sparse granules and fairly dense erect and subrecumbent pale hairs; the hind femora much thicker than the others, especially in ♂, and the hind tibiæ coarsely denticulate on the inner face in both sexes. *Venter* with rather sparse irregular asperate punctures, the intermediate ventrites in ♀ with the posterior half or third sloping abruptly and steeply downwards and quite glabrous.

Length 10·2–12·6 mm., breadth 3·6–4·8 mm.

MARQUESAS Is.: Hiva Oa, 2500–3000 ft., 12 ♂ ♂, 5 ♀ ♀, on pepper and other plants, xii. 1924 (*C. L. Collenette*).

The ♂ of this species is very distinctive, owing to the sinuation of the dorsal outline of the elytra and the absence of the lateral carina, together with the thickened hind femora. The nearest ally is *R. eximius*, Perk., 1928, from the same group of islands, of which the ♀ (♂ unknown) is larger and proportionately broader than that of *navicularis*; it is thinly clothed throughout with subrecumbent fulvous setæ interspersed with long erect setæ; the elytra are more coarsely sculptured and more sharply acuminate behind; the venter is sparsely clothed with fulvous setæ, without lateral patches.

HADRORRHINUS, Schh., 1834.

Schönherr ascribed two species to this genus, *lepidopterus*, Gyll., 1834, and *squamosus*, Boh., 1843, which were recorded as coming from South Africa. The types of these species are in the Oxford Museum, and there can be no question that the insects are Australian and not African. Various other species occur also in Australia, as indicated by Lacordaire (Gen. Col. vi. p. 169), but later workers appear to have confused them with *Polyphrades*—for example, *P. ampliatus*, Pasc., *P. basirostris*, Lea, and *P. collaris*, Lea, must all be transferred to *Hadrorrhinus*. These species differ from *Polyphrades* in having no postocular lobes on the prothorax, the scrobes being dorsal and inwardly curved, the epistome small and ill-defined, and the corbels of the hind tibiæ narrowly enclosed; whereas in *Polyphrades* the post-ocular lobes are distinct, the scrobes are sublateral and directed downwards, the epistome is large and well-defined, and the hind corbels are entirely open.

Parasystates hancocki, sp. n.

♂ ♀. Shiny black or piceous, with a few minute isolated greenish scales remotely and irregularly scattered on the elytra, and minute sparse subrecumbent pale setæ which are longer and more erect towards the apex.

Head strongly but shallowly punctate, very convex transversely on the vertex, somewhat flattened on the forehead, and with a very deep rounded median fovea. *Rostrum* about as long as broad, quite flat dorsally, with separated shallow punctures and short recumbent setæ, without furrows or carinæ; the inter-antennal area gently declivous, quite flat, and impunctate anteriorly or sometimes throughout; the apical margin distinctly sinuate in the middle. *Antennæ* with the scape gradually clavate, gently curved, and rather strongly punctate; the funicle with joint 1 equal to 2+3, joints in order of length: 1, 2, 3, (4, 7), (5, 6). *Prothorax* transverse, strongly rounded at the sides, broadest at the middle, constricted at base and apex, the latter being slightly narrower and truncate; the dorsum convex, with very shallow separated punctures, usually leaving a narrow median impunctate area and becoming denser laterally; the punctures aciculate and each bearing a short recumbent seta. *Elytra* subelliptical, rather broader in ♀, usually slightly aciculate in ♂ and very shiny in ♀, almost flat at the extreme base near the suture, but becoming more declivous laterally; the posterior lateral inflexion less marked than in previously described species, and practically similar in the two sexes; the longitudinal dorsal curvature flat in ♂ and highest before the middle, more convex in ♀ and highest behind the middle; the shallow striæ with close distinct punctures, the intervals being quite smooth, except for a few indistinct granules towards the apex, especially on intervals 6 and 7 in ♀. *Legs* with rather dense recumbent setæ; the femora finely aciculate, the tibiæ rugulose and the hind pair irregularly granulate on the inner face. *Venter* with very variable sparse obsolescent granulation; anal ventrite of ♂ flat and without impressions.

Length 7·5–9·6 mm., breadth 3·0–4·2 mm.

UGANDA: Mt. Elgon, 11,000 ft., 5 ♂♂, 3 ♀♀, 17. viii. 1929 (*G. L. R. Hancock*—type); N. Bugishu, 7500–9000 ft., 1 ♂, 1 ♀, i. 1929 (*Dr. G. D. H. Carpenter*).

The specimens from N. Bugishu have the prothorax a little more strongly and closely punctate on the disk, and the setæ on the elytra are slightly longer.

Distinguished from the previously described species of the genus by its smooth shiny upper surface and by the flattening of the basal margin of the elytra about the suture.

Prof. Aurivillius did not fix a type for his genus *Parasystates*; I therefore cite *P. subconvexus*, Aur., 1910, as the genotype.

Xenorrhinus costatus, sp. n. (Fig. 1.)

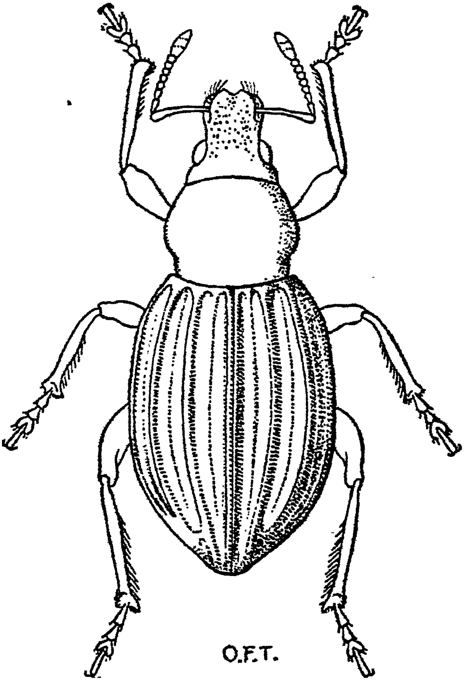
♀. Dull black, entirely bare, except for some short pale hairs on the sternum and a very few minute ones on the legs.

Head convex, transversely, finely shagreened above, with very sparse small irregular punctures and a small median fovea; finely striolate behind the eyes and alutaceous beneath; the eyes less convex than in the previously described species. *Rostrum* about as long as broad, parallel-sided at the base and roundly dilated at the genæ, gently convex above both longitudinally and transversely, quite even, finely shagreened and more closely punctate than the head, the punctures being of unequal sizes, broadly and rather deeply sinuate at the apex, the lateral angles of the sinuation being rather obtusely prominent; the genæ and lower surface coarsely punctate, the latter with two large rounded foveæ. *Antennæ* short, with the scape gradually clavate and not exceeding the hind margin of the eye; the funicle with the two basal joints subequal, the remainder moniliform, 7 being a little broader than the others. *Prothorax* transverse, strongly rounded at the sides, widest at about the middle, narrowing regularly to the apex, but broadly and abruptly constricted behind, the base being gently arcuate and as wide as the apex; the dorsum slightly convex longitudinally, finely shagreened, entirely even, with variable scattered unequal punctures, turning to fine close granulation at the sides, and the granules becoming larger and more distant on the prosternum. *Elytra* broadly ovate; intervals 1, 3, 5, 7 broadly costate, rather shiny and very sparsely punctate; intervals 2, 4, 6, 8 with much narrower and lower costæ, which are often partly obliterated; the broad sulci opaque and shagreened, each with a row of small distant punctures and with scattered minute granules; intervals 9 and 10 not costate, shagreened and finely granulate, the granules being sparse on 9 and dense on 10. *Legs* comparatively shiny, with very sparse minute punctures; the tibiæ not granulate on the inner face; the tarsi with joint 2 strongly transverse on the front pair and longer than broad on the hind pair.

Length 8·3–9·0 mm., breadth 4·5–5·0 mm.

Uganda: N. Bugishu, 7500–9000 ft., 1 ♀, i. 1929 (*Dr. G. D. H. Carpenter*); Bulambuli, Mt. Elgon, 4 ♀♀, 21. viii. 1929 (*G. L. R. Hancock*—type).

Fig. 1.



Xenorrhinus costatus, sp. n.

Differs from the two previously known species, *X. lobeliæ*, Auriv., and *X. brevirostris*, Auriv. (Ark. Zool. xviii. A, no. 23, 1926, pp. 14–15), in its costate and opaque elytra, and in having the two basal joints of the funicle subequal. In this species, as in *lobeliæ*, the base of the elytra is vertically truncate, whereas in *brevirostris* it is gradually declivous.

Subfamily *LEPTOPINÆ*.

APORIMUS, gen. nov.

Head globose, separated from the rostrum by a curved furrow; the eyes flattened, broadly ovate, acuminate below. *Rostrum* stout, obtusely angulate at the sides or rounded in the basal half; the epistome small, ill-defined, emarginate in the middle; the scrobes mostly visible from above but curving sharply downwards well in front of the eyes; the mandibles unidentate, trisetose, and with a very small scar; the mentum small and without setæ, the submentum with two long oblique setæ. *Antennæ* short, the scape clavate, reaching the hind margin of the eye; the funicle 7-jointed, with 1 longer than 2+3; the club elliptical, rather sharply pointed. *Prothorax* transverse, with well-developed post-ocular lobes. *Scutellum* invisible. *Elytra* ovate, without humeral or subapical calli, very steeply declivous behind, subacuminate and jointly rounded at the actual apex, and with ten complete striæ. *Legs* with the femora pedunculate, unarmed; the anterior pairs of tibiæ with a small mucro, the hind pair with the corbels open; the tarsi short and broad, joint 2 transverse, the claws small and connate at the base. *Sternum*: the front coxæ in the middle of the prosternum; the mesosternum with the side-pieces very unequal and the median coxæ narrowly separated; the metasternum shorter than the median coxæ, the episternal suture visible only in its anterior half, and the hind coxæ not touching the elytra. *Venter* with the intercoxal process broadly truncate, the first suture more or less sinuate, and ventrite 2 (4) as long as the next two together.

Genotype: *Cneorrhinus viridanus*, Boh., 1840.

Two other small South African weevils must also be referred to this genus, *Cneorrhinus languidus*, Boh., and *oblongus*, Boh.

This genus will come in the vicinity of *Orimus*, Schh. (known to me from the description only), which differs *inter alia* in having the two basal joints of the funicle equal, the femora gradually dilated, and the tarsal claws free.

BARYOPADUS, Pasc., 1870.

In his revision of the genus *Leptops* (Ann. Soc. Ent. Belg. l. 1906, pp. 313–354) Mr. A. M. Lea sank *Baryopadus* as a synonym of *Leptops* on the ground that the tarsi, which Pascoe described as setose and very distinctive, are not really different from those of allied species of *Leptops*. There are in the British Museum two specimens determined by Mr. Lea as *Baryopadus corrugatus*, Pasc., and these account for the above divergence of opinion, in that they do not belong to Pascoe's species, although closely resembling it superficially. In my opinion *Baryopadus* should be retained as a separate genus.

Subfamily *TANYRRHYNCHINÆ.*

In my revision of this subfamily a good many years ago (Ann. & Mag. Nat. Hist. (8) i. 1908, p. 9) the genera *Stramia*, Mshl., and *Solenorrhinus*, Schh., were excluded from it on the ground that the mentum was small, leaving the maxillæ and their palpi entirely exposed. Additional material and further study has shown, however, that the genera in this group are by no means consistently adelognathous, the development of the mentum showing considerable variation. It is therefore proposed to restore the above-mentioned genera to the Tanyrrhynchinæ, and with them must be associated the Australian *Nemestra*, Pasc., 1872, and the New Zealand *Lyparopais*, Broun, 1893, both of which are closely allied to *Stramia*.

Subfamily *DIABATHRARIINÆ.*

Strongylorrhinus clarki, sp. n.

♂ ♀. Derm black, with dense ferruginous scaling; the prothorax usually with two broad darker discal stripes, which are sometimes obsolete; the elytra sometimes uniform ferruginous, but usually with very indefinite and variable darker and paler mottling, and often with a faint paler patch behind the middle, but never with the definite oblique band of *S. ochraceus*, Waterh.

Head with coarse punctures each containing a dark curled scale-like seta, with a very deep sulcus (normally filled with scaling) along the inner edge of each eye anteriorly; the forehead with a very deep median furrow, continued on the base of the rostrum; head of ♂ less widened behind than in ♀ and with the forehead slightly more convex. *Rostrum* much shorter than the pronotum (4 : 7), very similar in the two sexes, strongly punctate throughout and normally squamose right up to the apex, but the apical punctures somewhat less rugose in ♀. *Antennæ* with the scape nearly reaching the eye; the funicle densely clothed with broad appressed scales and without projecting ribbon-like setæ, the joints in order of length: 1, 2, (3, 7), (4, 5, 6); joint 3 as long as broad, 4–7 transverse, 7 annexed to the club. *Prothorax* almost as long as broad (taking the full median length), slightly narrowing (sometimes parallel-sided) from the base to the middle and thence more rapidly, very shallowly constricted near the apex, and with the apical margin arcuate dorsally; the dorsum rather uneven, very coarsely punctate, the interspaces finely rugulose but hidden by scaling, the punctures showing as bare black spots, each containing a very short dark setæ on the dark areas and a longer whitish one on the paler areas. *Scutellum* with dense elongate whitish scales. *Elytra* narrow, elongate, each with a separate short process at the apex (occasionally contiguous); the striæ containing large separated punctures (partly obscured by scaling) which diminish behind, but those in the post-humeral area not larger than the others, and striæ 1–3 not converging at the base; each puncture containing a broad recumbent whitish scale-like seta; the intervals somewhat uneven, but all equally raised, except int. 3, which bears a short low elevation at some distance from the base and a small callus on the raised basal margin; the small rounded convex scales equally dense throughout. *Underside* densely squamose throughout.

Length 7·2–13·5 mm., breadth 2·8–4·8 mm.

WESTERN AUSTRALIA: 2 ♂♂, 3 ♀♀; Nicol Bay, 1 ♂; South Perth, 1 ♂, 2 ♀♀, xii. 1903, 1 ♂ (type), x. 1905 (*H. M. Giles*); Swan R., 2 ♂♂, 2 ♀♀ (*J. Clark*); Fremantle, 3 ♀♀. SOUTH AUSTRALIA: 2 ♀♀. NEW SOUTH WALES: Sydney, 1 ♂, 3 ♀♀, 1926 (*W. W. Froggatt*).

In all the collections that I have seen this species stands under name of *Strongylorrhinus ochraceus*, Schönh. The latter species, however, was not described by Schönherr, but by G. R. Waterhouse (Trans. Ent. Soc. London, (3) i. 1862, p. 227), and the three female specimens on which he based his description were all from Tasmania, and are now in the British Museum. His species is certainly distinct from the widely distributed form on the mainland, being a proportionately broader insect, with a large subtriangular lateral patch behind the shoulders which appears to be darker and with larger punctures owing to the sparseness of the scaling. It also differs in the following characters:—*Head* with forehead less convex and the median furrow much broader. *Rostrum* much longer and finely punctate (♀). *Antennæ* with the apex of the scape remote from the eye; the funicle clothed with narrow scales and projecting ribbon-like setæ, the joints all subclavate, 1–5 longer than broad, 6 as long as broad, 7 transverse and not annexed to the club. *Elytra* separately rounded at the apex, not appendiculate; striæ 1–3 converging at the base; interval 3 without a basal callus, but interval 4 with a much larger one than that of *ochraceus*. *Underside* setose down the middle and squamose at the sides.

S. clarki is recorded as forming galls on small branches of the ironbark (*Eucalyptus resinifera*), and is dedicated to my friend Mr. John Clark, who has added so much to our knowledge of Australian ants, and to whom I am indebted for a fine collection of Australian Curculionidæ.

Subfamily *Cleoninæ*.

Hypolixus achyranthis, sp. n.

♂ ♀. Derm piceous to red-brown; prothorax with a subtriangular pale yellowish patch on each side, the upper edge of which runs obliquely from the basal angle inwards to a short distance from the apical margin at a point on a line with interval 3 on the elytra; elytra with two broad irregular macular yellowish bands, one sub-basal and much interrupted dorsally, the other subapical and much better defined, also with a scutellar patch and some irregular spots between the bands and at the apex; the underside with rather thin yellowish pubescence, without any bare black patches on the venter.

Head finely punctate above; the forehead somewhat flattened, 1·5 times as wide as the apex of the rostrum, more coarsely punctate in front, and with a deep elongate median fovea. *Rostrum* of ♂ distinctly conical, coarsely and confluently punctate in the basal half and there with a shallow depression on each side of the median line, finely punctate anteriorly and sometimes with a trace of a shallow median sulcus, and markedly pubescent throughout, the dorsal outline flat; of ♀, much more rapidly narrowed than in ♂ and with the dorsal outline shallowly concave near the base, less strongly punctate basally, almost impunctate and very shiny in front, and with thinner pubescence. *Antennæ* piceous, with the basal joint of the funicle as long as 2+3, 2 longer than broad, the remainder transverse and widening distally, 7 as long as the basal joint of the club; the club slightly longer than the apical five joints of the funicle. *Prothorax* subconical, widest at the base, a little shorter than the basal width, with the sides almost straight and the apical margin moderately arcuate; the dorsum gently convex longitudinally, with comparatively fine irregular separated punctures and minute punctulation between them, and a very deep short sulcus in the middle of the base; the sides with a broad shallow impression at or before the middle, and usually a small shiny spot above it on the upper edge of the lateral pubescent patch and another below it in the patch. *Elytra* subelliptical, with a distinct humeral callus and a rather deep subapical impression; the striæ scarcely impressed on the disk, with the punctures smaller than usual and markedly smaller in the pubescent bands, those in stria 1 smaller and more numerous than those in the adjoining striæ; a large transverse oblong scutellar depression, bounded laterally by a prominent elevation on interval 3, which is finely granulate, the scutellar margins not elevated.

Length 10·8–11·7 mm., breadth 3·6–4·2 mm.

ANGLO-EGYPTIAN SUDAN: Ganib Barakhat, 3 ♂ ♂, 2 ♀ ♀, vii.–viii. 1925 (*H. B. Johnston*—type); Ganib El Asad, 2 ♂ ♂, 2 ♀ ♀, ix. 1925 (*H. B. J.*).

The specimens were all bred from *Achyranthes aspera*, L.

In Petri's key to the genus (Verh. Senckenb. Ver. lxv. Festschr. 1914, p. 11) this species runs down to the section containing *H. nubilosus*, Boh., and *pulvisculosus*, Boh., but both these insects have a sharp dividing-line on the head between the part of the vertex normally covered by the pronotum and the anterior portion; of this there is no trace in *achyranthis*. The latter species is specially characterised by the great width of the forehead, which is distinctly wider than the apex of the rostrum, the very deep elongate impression in the middle of the base of the pronotum, and the backward extension of the granular elevation at the base of interval 3 on the elytra for the whole length of the scutellar depression.

Subfamily *APIONINÆ*.

Apion (*Aplemonus*) *stigma*, sp. n.

♀. Derm bronze-black, thinly clothed above and below with short recumbent white setæ; the elytra with a small oblong patch of dense white setæ at about one-fourth from the base, and just behind the highest part a broad transverse band in which the setæ are dark and inconspicuous.

Head a little longer than broad, with coarse shallow punctation; the forehead shallowly impressed, and with an elongate median fovea; the eyes almost flat, much longer than the postocular space. *Rostrum* somewhat shorter than the pronotum (5 : 6), widening from the base to the supra-antennal dilatation (at one-fourth), subcylindrical in front and not widened at the apex, with close strong punctation. *Antennæ* with joint 2 of the funicle longer than broad, 3–6 about as long as broad, 7 transverse. *Prothorax* a little longer than broad, widest at the base, slightly narrowing from there to the apex, with the sides straight; the apical margin subtruncate dorsally, the base shallowly bisinuate; the dorsum very shallowly and coarsely punctate, with a very deep short median sulcus in the basal half and a broad shallow transverse impression at one-fourth from the apex. *Elytra* subpyriform, with prominent but sloping shoulders, strongly rounded at the sides, and widest well behind the middle; the dorsal outline very convex, highest at about the middle, the anterior slope flat, the posterior declivity much steeper and convex; the striæ broad, deep, and strongly punctate, scarcely diminishing behind, each puncture covered by a recumbent white seta; the intervals broad, gently convex and rugulose. *Legs* with scattered white recumbent setæ; the second tarsal joint bearing a few white setæ dorsally, with the apical margin subtruncate, and the lateral angles not produced.

Length 2·7–3·2 mm., breadth 1·4–1·5 mm.

ANGLO-EGYPTIAN SUDAN: Abu Hashim, 3 ♀ ♀, on *Acacia mellifera*, iii. 1929 (*R. C. Maxwell-Darling*).

Nearly allied to *A.* (*A.*) *zizyphi*, Mshl., 1906 (of which *standfussi*, Wagn., 1907, is a synonym), but this South African species differs in its much shorter and less conspicuous setæ, especially on the elytra, and in the absence of the sutural white patch; further, the postocular space on the head is about equal to the length of the eye; the base of the pronotum is truncate; the elytra are more dilated and more elevated; and the second tarsal joint bears no white setæ, and its apical margin is deeply sinuate, with the lateral angles sharply pointed.

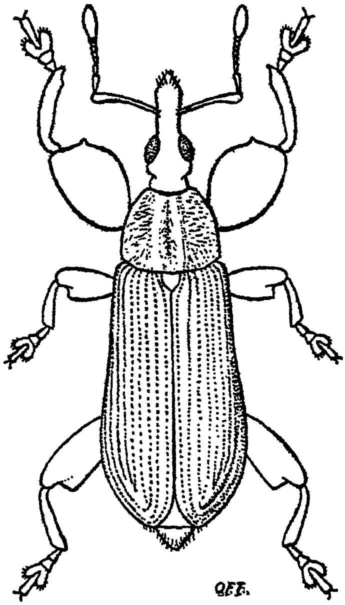
On the same *Acacia* Mr. Darling also obtained two specimens of *A.* (*A.*) *arabicum*, Wagn., 1909, which had not previously been recorded from the Sudan.

Subfamily *ULOMASCINÆ*.

Cratopechus gedyei, sp. n. (Fig. 2.)

♂ ♀. Uniform piceous brown, the limbs paler. The whole body much flattened. *Head* longer than broad, the space between the eye and the prothorax as long as the eye, shallowly constricted at the base in ♂, much more deeply so in ♀; the dorsum flat, with minute obsolescent punctation, and a small median puncture; the eyes moderately convex; no dense hairs on the lower surface in ♂. *Rostrum* comparatively short, a little shorter than the head (7 : 8) in ♂, slightly longer in ♀ (9 : 8), almost parallel-sided, but slightly wider at the apex (especially in ♀), the apical margin truncate; the dorsum with minute obsolescent punctation in both sexes. *Antennæ* inserted at about the middle in ♂ and behind it in ♀; the scape much exceeding the eye, distinctly curved, compressed in the basal two-thirds and abruptly clavate; joint 1 of the funicle a little shorter than the next three together, 2 much longer than broad, the rest transverse. *Prothorax* transverse (11 : 15), gradually narrowing from the base to the middle, then more rapidly curving in to the apex; the base broadly arcuate, the apex sinuate, the basal lateral angles rounded; the dorsum minutely punctate, with a broad shallow median longitudinal impression, and an indefinite flattened area on each side of it, all these being covered with fine recumbent pubescence (easily abraded). *Scutellum* transverse, with the hind margin broadly arcuate. *Elytra* very gradually widening to four-fifths from the base, separately rounded at

Fig. 2.



Cratopechus gedyei, sp. n.

the apex, jointly truncate in the middle of the base as far as stria 5, the shoulders projecting slightly and obtusely forwards; the rather broad shallow striæ containing fine close punctures, the intervals subcostate and with fine sparse pubescence. *Legs*: the posterior pairs of femora flattened and elliptical, with an excision inferiorly at the apex, the inner angle of which forms a subrectangular tooth; the front pair much larger than the others, flat beneath, convex above, irregularly pear-shaped, with the inner edge much more convex than the outer one, and with a small sharp prominent tooth near the apex, and without any fringe of hairs in ♂; the tibiæ simple and similar in the two sexes; the tarsi not fringed in ♂.

Length 3·6 mm., breadth 1·3 mm.

KENYA COLONY: Thika, 1 ♂, 1 ♀, on reeds, xi. 1928 (*A. F. J. Gedye*).

Distinguished from the genotype, *C. arundinarum*, Mshl. (Ann. & Mag. N. H. (10) i. 1928, p. 420), *inter alia*, by its dark colour, much longer rostrum, shorter and more convex eyes, and shorter neck; by the transverse, sulcate, and apically sinuate pronotum, the much smaller front femora, and the entire absence of long hairs on the lower surface of the ♂.

By some unaccountable error the measurements of *C. arundinarum* were given as: 18–18·8 by 6·2–6·6 mm.; they should have read: 3·6–3·8 by 1·2–1·3 mm.

Subfamily *ITHYPORINÆ*.

Lacordaire separated *Mecocorynus*, *Ectatorrhinus*, and *Conotrachelus* from the rest of his "Ithyporides vrais" on the ground that they have the rostral scrobes confluent at the base, but this character is really illusory.

Mecocorynus and *Ectatorrhinus* can be separated from the remaining genera by the mouth-parts; the buccal cavity is in the form of a narrow elongate V, without any definite peduncle to the submentum, and the mentum is elongate. In the rest of the group the buccal cavity is much broader, and there is a distinct peduncle to the submentum, so that the posterior outline of the cavity is roughly in the form of a W, and the mentum is very small and transverse; moreover, the mandibles in the two above-mentioned genera are not decussate.

Again, Lacordaire's character for separating *Mecocorynus* and *Ectatorrhinus*—namely, the contact or separation of the anterior coxæ—does not now hold good with the additional species known to us. The genera can, however, be distinguished by the form of the antennal club, which in *Mecocorynus* is cylindrical and unsegmented and in *Ectatorrhinus* is ovate and segmented.

Unfortunately, Pascoe included two species of *Ectatorrhinus* in his composite genus *Aryptæus* (Ann. & Mag. N. H. (5) x. 1882, p. 451), and these were therefore not unnaturally overlooked by Dr. Heller in his recent valuable revision of this genus (Wien. Ent. Zeit. xliii. 1926, p. 149). The following synonymy must, therefore, be noted:—

Ectatorrhinus (*nanus*, Hllr., 1908) = (*Aryptæus*) *trinarius*, Pasc., 1882.
Ectatorrhinus (*conifer*, Hllr., 1926) = (*Aryptæus*) *galeotes*, Pasc., 1882.

Pascoe did not mention a type for *Aryptæus*, and the species that he figured, *A. suturalis*, Pasc., is therefore now selected as the genotype. As a result of this we have the following synonymy:—

(*Aryptæus*, Pasc., 1882) = *Colobodes*, Schönh. 1837.
(*Aryptæus pustulosus*, Pasc., 1882) = *Colobodes bilbergi*, Boh., 1837.

Further,

(*Marmarochelus*, Desbr., 1890) = *Ectatorrhinus*, Lac., 1866.
(*Marmarochelus atkinsoni*, Desbr., 1890) = *Ectatorrhinus* (*Sipalus*?) *porosus*, Walk., 1859.

This latter species and *E. femoratus*, Pasc., 1872, are not included in Dr. Heller's revision.

Subfamily *ISORRHYNCHINÆ.*

Lobotrachelus coffeæ, sp. n.

♂ ♀. Derm brown to piceous; the antennæ, tibiæ, and tarsi testaceous, the femora and rostrum darker; the upper surface rather thinly clothed with subrecumbent setiform whitish scales, which are slightly more dense along the suture of the elytra, and with a dense elongate white patch on the median basal lobe of the pronotum formed of broader imbricated white scales, but no dorsal patches in the lateral angles; the lower surface densely clothed throughout with elongate broad imbricated white scales.

Rostrum of ♂ with dense white scaling throughout, except at the extreme apex, and covering the sharp median carina; that of ♀ thinly squamose in the basal half only, the apical half bare and sparsely punctate. *Prothorax* with dense shallow ocellated punctures, each bearing a setiform scale; these scales becoming broader laterally, and usually a few broader ones along the median line and on the basal margin midway between the median lobe and the lateral angles; the dorsal edge of the dense prosternal scaling sharply defined and almost straight. *Elytra* with the deep striæ obsoletely punctate; the intervals shallowly punctate and slightly rugulose, each with two rows of scales, those on interval 5 being a little broader than the others on the apical half. *Legs*: the femora with fairly dense elongate white scales, the tooth on the median pair sharp and spine-like, that on the other pairs much smaller or even obsolescent. *Venter* of ♂ with the scales in the median area all fimbriated; the anal ventrite of ♂ with a broad deep excavation, which is mostly bare, the carinate lateral edges being fringed with setæ.

Length 2·4 mm., breadth 1·2 mm.

Anglo-Egyptian Sudan: Obbo, Mongalla, 2 ♂ ♂, 1 ♀, on wild coffee plants, 8. iii. 1929 (*W. Ruttledge*).

The nearest ally of this species appears to be *L. variabilis*, Hust., 1924, which is known to me from description only. The latter differs in having yellowish scales mingled with the whitish ones on the upper side, the pronotum has a large triangular white patch in the basal lateral angles, and the white scaling on the sternum is not even, but forms denser patches on the episterna and before the front coxæ.

Subfamily *MENEMACHINÆ*.

ACATUS, gen. nov.

Head with the eyes well separated, but the forehead narrower than the base of the rostrum. *Rostrum* rather stout, parallel-sided, curved; the scrobes oblique and passing rapidly beneath, not continued beyond the antennæ, which are inserted beyond the middle of the rostrum. *Antennæ* with the scape shorter than the funicle, slender and gradually clavate; the funicle not dilated apically, joint 7 not annexed to the club, which is comparatively small, but broadly ovate. *Prothorax* transverse, bisinuate at the base, the apex oblique laterally. *Scutellum* small but distinct. *Elytra* subtriangular, widest at the shoulders, concealing the pygidium, with ten striæ, and a large shallow triangular impression on the disk. *Legs* stout, the femora clavate, each bearing a large sharp triangular tooth, the hind pair reaching to about the apex of ventrite 2; the tibiæ compressed, bent at the base, carinate dorsally, with a stout straight uncus, the inner apical angle being sharply acuminate; the tarsi with joint 2 longer than broad, 3 very broad, and the claws strongly appendiculate. *Sternum* with the front coxæ rather narrowly separated; the mesosternum with the intercoxal process almost vertical, very short, scarcely extending beyond the anterior line of the coxæ, broadly truncate, and as wide as a coxa; the mesepimera rising and almost visible from above; the metasternum between the coxæ about as long as a coxa, the metepisterna broad. *Venter* with the intercoxal process very broadly and flatly rounded, subogival, the first suture fused and arcuate in the middle, ventrite 2 laterally as long as 3+4.

Genotype: *Acatus rhombicus*, sp. n.

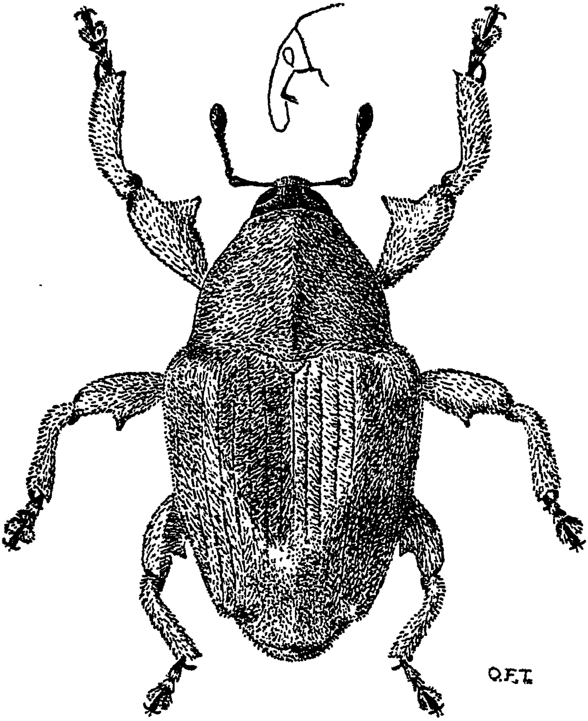
An isolated genus, but coming nearest to *Hoplitopales*, Schh., 1843. The latter differs in its more ovate general shape; the head is more prominent, with the eyes much closer; the tibiæ have the uncus strongly incurved, and the inner apical angle rounded; the claws are simple; the mesosternal process is much narrower than the coxæ; the ventral process is narrowly rounded, and ventrite 2 longer than 3+4.

Acatus rhombicus, sp. n. (Fig. 3)

♂ ♀. Derm piceous, densely clothed with narrow brown scales mingled with paler ones; the pronotum with a large subtriangular discal patch of brown scales, the lateral areas being usually much paler; the elytra with a very indefinite paler line running from the shoulder to the top of the declivity.

Head somewhat flattened on the vertex, with rugose confluent punctation (hidden by scaling); the forehead nearly as wide as an eye, with a small median fovea. *Rostrum* stout, moderately curved, about as long as the pronotum; coarsely punctate in ♂, fairly densely squamose behind the antennæ, and setose apically; the apical area more finely punctate and less densely setose in ♀. *Antennæ* with the two basal joints of the funicle subequal, 3–5 as long as broad, 6 and 7 transverse. *Prothorax* transverse (4:3), widest at the base, gently curved at the sides, rather rapidly narrowing anteriorly, and scarcely constricted at the apex; the base deeply bisinuate, the apex truncate; the dorsum with fine dense confluent punctation, with a low median carina, the sculpture almost hidden by the dense narrow elongate scales. *Scutellum* rounded, squamose. *Elytra* widening from the base to the rounded shoulders, thence narrowing with a slight curve to the apex, which is rounded; the basal margin jointly trisinuate, the posterior calli prominent; the common median impression deepest at the base of the suture and gradually disappearing behind the middle, extending laterally to about stria 3 at the base, and narrowing behind; usually a shallow transverse impression on intervals 3 and 4 at about one-fourth from the base; the striæ fine and shallow, the intervals broad, and with dense shallow confluent punctation, which is mostly hidden by the scaling. *Legs* densely squamose; the laminate tooth on the front femora twice as big as those on the posterior pairs; the front tibiæ broader than the others, strongly curved on the dorsal edge, and sinuate inferiorly on the basal half. *Underside* densely squamose; ♂ with a median basal furrow on the venter and with the anal ventrite tumid in the middle.

Fig. 3.



Acatus rhombicus, sp. n.

Length 5·0–5·5 mm., breadth 3·0–3·25 mm.

N.E. RHODESIA: Upper Luangwa R., 1 ♂, vii.–viii. 1910 (*Dr. S. A. Neave*). PORTUGUESE E. AFRICA: Lourenço Marques, 2 ♂ ♂, 7 ♀ ♀, vi. 1921 (*C. B. Hardenburg*—type); Delagoa Bay, 1 ♀; Chaichai, 1 ♂, 1 ♀, viii. 1924 (*Hardenberg*).

Acatus rhombicus natalensis, subsp. n.

Three specimens from Natal differ from the typical form only in having all the scales much longer, which gives them a distinctly rougher appearance.

NATAL: Verulam, 1 ♂, 1 ♀, vii. 1897 (*G. A. K. M.*); Umgeni, 1 ♂, vii. 1897 (*G. A. K. M.*—type).

Subfamily *BARIDINÆ*.

Lophobaris piperis, sp. n.

♂ ♀. Derm black, moderately shiny, thinly clothed with narrow black scales, and with indefinite markings formed of paler scales; prothorax with a very indistinct median stripe, and an oblique lateral one on each side, formed of clavate pale brownish scales; elytra with the following markings of yellowish scales: a few scales at the base of interval 2, and a longer (0·5 mm.), much denser patch at the base of 3, a small subapical patch, a few scales on the humeral callus, and variable isolated yellowish scales scattered over the disk; the underside not squamose, but with a pale broad seta in each puncture.

Head with dense reticulate punctation. *Rostrum* about as long as the head and prothorax in ♂, longer in ♀, stout, strongly curved, with the antennæ inserted at a little beyond the middle in ♀, and at two-thirds from the base in ♂; the dorsum similarly sculptured in the two sexes, with coarse, longitudinally confluent punctures and five narrow sinuous carinæ, the outer ones being sometimes obsolescent; a few scales at the base, including two or three broad erect ones on each side. *Antennæ* piceous, with joint 2 of the funicle almost as long as 3+4. *Prothorax* transverse (7 : 5), almost parallel-sided from the base to the middle, then narrowing in a curve, and strongly constricted near the apex; the front margin truncate dorsally and with distinct post-ocular lobes; the dorsum almost flat longitudinally, closely set throughout with large deep punctures, which become much coarser at the sides, each puncture containing a suberect spatulate scale. *Scutellum* small, rounded, bare. *Elytra* broadly ovate, with the shoulders prominent, rather strongly rounded at the sides, with the posterior callus well marked, a much smaller callus behind it at the junction of intervals 3 and 9, and the apex rounded; the striæ deep and containing deep separated punctures, stria 1 not quite reaching the base, and 2 and 3 sinuate basally; the intervals broad and flat, bearing a row of very shallow squamigerous punctures, each of which is bounded in front by a short transverse carina, the rows being duplicated in the basal half on intervals 2–4; the black scales spatulate, but narrower than the pale ones. *Legs* with coarse reticulate punctation and subrecumbent squamiform setæ; the front femora with three or four minute teeth on the lower surface; the middle pair with one rather larger and one or two minute ones, and the hind pair with two or three minute teeth.

Length 3·2–4·2 mm., breadth 1·5–2·1 mm.

Sumatra: Soengei Liat, Banka I., 5 ♂♂, 3 ♀♀, on *Piper nigrum* (*J. van der Vecht*).

Differs from the genotype, *L. serratipes*, Mshl. (Bull. Ent. Res. xvii. 1927, p. 216, pl. xix. fig. 12), in the absence of tufts of scales on the upper surface and of the median prominence on the pronotum, in the straight striæ on the elytra, and in the regular punctures and transverse carinæ on the intervals.

Dr. S. Leefmans, who kindly forwarded these specimens, informs me that this weevil is an important pest of pepper, and is apparently widely distributed. He has received specimens from Peureula, in Atjeh, North Sumatra, and from Moeara Doea, South Sumatra; Mr. van der Vecht has also found it near Buitenzorg, Java.

Subfamily *Cossoninæ*.

Phlœophagus marginalis, sp. n.

Colour rather shiny black; the apex of the rostrum testaceous; the elytra light testaceous brown, with the suture and the lateral margins (except at the apex) narrowly blackish; the legs and antennæ light testaceous brown, the club of the latter fuscous.

Head subconical, obsoletely constricted behind the eyes, which are feebly convex, and with fine sparse punctures. *Rostrum* a little longer than the head (8:7), very slightly widening from base to apex, smooth and punctate like the head. *Antennæ* with joint 2 of the funicle much shorter than 1, which is about as long as 2+3, 2 as long as broad, the rest transverse. *Prothorax* somewhat longer than broad, gently rounded at the sides, widest at one-fourth from the base, feebly constricted near the apex, which is distinctly narrower than the subtruncate and immarginate base; the dorsum flat longitudinally, finely aciculate, and with fairly even small separated punctures, these becoming shallower and sparser on the prosternum. *Scutellum* distinct, almost circular, shiny black. *Elytra* narrowly elongate, more than twice as long as broad, jointly truncate at the base, with very shallow and shallowly punctate striæ, those near the suture and extreme lateral margin being rather deeper than the others; the intervals with very indistinct minute shallow punctures. *Legs* with the front tibiæ gradually widening from base to apex, and without any spine at the inner apical angle; the second joint of the tarsi not longer than broad. *Underside* with sparse fine punctation, which is rather larger and closer laterally; ventrites 3 and 4 not transversely carinate.

Length 3·6–4·2 mm., breadth 1·0–1·2 mm.

UGANDA: Bulambuli, 9000 ft., Mt. Elgon, 9 specimens, viii. 1929 (*G. L. R. Hancock*).

From the other known African species this may be recognised by its distinctive coloration, elongate form, and very shallow striæ.

NOTES ON SYNONYMY, ETC.

Entimus (*plebeius*, Roel., 1875) = *arrogans*, Pasc., 1873.

Entimus (*speciosus*, Er., 1847) = *granulatus*, L., 1764.

(*Polytelidius*, Bovie, 1908) = *Polydius*, Schh., 1826.

(*Polydius donceli*, Bovie, 1908) = *Cydianerus argenteus*, Boh., 1840.

Polydius (*orbignyi*, Chev., 1878) = *cœlestinus*, Perty, 1830, var.

(*Polydius*) *pascoei*, Bovie, 1908, is a *Cydianerus*.

(*Cydianerus*) *atrox*, Germ., 1824, is a *Polydius*.

Rhigus (*brunneus*, Bovie, 1907) = *tribuloides*, Pall., 1781.

Rhigus (*tribuloides*, Bovie, 1908, *nec* Pall.) = *vespertilio*, Pasc., ♂.

(*Brachyolus punctipennis*, Sharp, 1886) = *Inophlœus villaris*, Pasc., 1875.

The genotype of *Siteutes*, Schh., *S. albicinctus*, Boh., 1843, of which I have seen the type, is undoubtedly a *Sciobius*, and therefore (*Siteutes*, Schh., 1843) sinks as a synonym of

Sciobius, Schh., 1826. In Lacordaire's classification *Siteutes cirricollis*, Boh., and *S. multicarinatus*, Boh., run down to the genus *Embrithes*, Schh., to which they should provisionally be referred.

Elytrurus (*horizontalis*, Fairm., 1881) = *subvittatus*, Pasc., 1881, ♂.

Platypterocis, Lea, 1914, was placed by its author in the Rhytirrhininæ near *Ophryota*, Pasc.; but the genotype is adelognathous and has distinct mandibular scars—it must therefore be transferred to the Otiorrhynchinæ, falling into Lacordaire's group "Peritelides."

Lachnopus (*wolcotti*, Mshl., 1926) = *plumipes*, Perroud, 1853.

Brachycerus (*acerbus*, Gyll., 1840) = *intutus*, Gyll., 1840.

Brachycerus (*crispatirostris*, Gyll., 1840) = *scutirostris*, Germ., 1833.

Brachycerus (*cristatus*, Pér., 1885) = *fascicularis*, Oliv., 1807.

Brachycerus capito, Pasc., is not a synonym of *stellaris*, Oliv., but a distinct species.

Brachycerus (*dorsomaculatus*, Qued., 1888) = *inæqualis*, Oliv. 1790, which is not a synonym of *tauriculus*, Sparrm. but a distinct species.

Brachycerus (*inæqualis*, Thunb., 1799, *nec* Oliv.) = *thunbergi*, Gyll., 1840.

Brachycerus (*ebullinus*, Pér., 1888) = *zeyheri*, Gyll., 1840.

Brachycerus (*gryphus*, Pasc., 1887) = *atrox*, Gerst., 1871.

Brachycerus (*honorabilis*, Brancsik, 1897) = *annulatus*, Gerst., 1855.

Brachycerus (*loquax*, Hartm., 1906) = *indutus*, Pér., 1896.

Brachycerus margaritaceus, Germ., is not a synonym of *tuberosus*, Wied., but a distinct species.

Brachycerus (*mamillatus*, Auriv., 1926) = *strumosus*, Pasc., 1887.

Brachycerus (*nebulosus*, Oliv., 1807) = *tauriculus*, Sparrm., 1785.

Brachycerus (*piger*, Gyll., 1840) = *vestitus*, Gyll., 1840.

Brachycerus (*pustulosus*, Gyll., 1833) = *detritus*, Thunb., 1799.

Brachycerus (*reflexus*, Gyll., 1840) = *tauriculus*, Sparrm., 1785.

Brachycerus (*rugipes*, Gyll., 1840) = *variolosus*, Oliv., 1790.

Brachycerus (*setiger*, Gyll., 1840) = *fasciculosus*, Germ., 1833.

Brachycerus (*tuberosus*, Wied., 1821) = *gemmatus*, Oliv., 1807.

Brachycerus (*ulcerosus*, Gyll., 1840) = *gemmifer*, Germ., 1833.

Brachycerus (*varius*, Pér., 1888) = *erinaceus*, Oliv., 1807.

(*Xenostes*, Simpson, 1890) = *Brachyceropsis*, Auriv., 1885.

(*Xenostes jamesoni*, Simpson, 1890) = *B. verrucosa*, F., 1801.

Oreoscotus, Auriv., 1910, was referred by its author to the subfamily Rhyparosominæ; its claws, however, are distinctly appendiculate, and it should be placed in the Anthonominæ.

(*Heteraomus*, Broun, 1893) = *Saphorrhynchus*, Sharp, 1883.

(*H. argentatus*, Broun, 1893) = *S. longicornis*, Sharp, 1883.

(*Hyperoides*, Mshl., 1914) = *Listroderes*, Schh., 1826.

Lixus (*roccattii*, Camerano, 1907) = *bidentatus*, Klb., 1898.

Many of the species described by Fabricius from the Hunter collection (now in the Glasgow University Museum) could not be identified or placed in his own genera by Schönherr, and were therefore relegated by him to an appendix in his great monograph. Most of these species were consequently omitted from Gemminger and Harold's Catalogue, and have thus not unnaturally been overlooked by later workers. Having been able to examine the types of some of the Curculionidæ, I have to record the following synonymy:—

Euscelus (*bipustulosus*, Jek., 1860) = (*Curculio*) *biguttatus*, F., Syst. Ent. i. 1775, p. 130.

Cholus (*wattsi*, Mshl., 1922) = (*Curculio*) *spinipes*, F., Spec. Ins. i. 1781, p. 174.

Heilipus (*perseæ*, Barber, 1920) = (*Curculio*) *trifasciatus*, F., Mantissa, i. 1787, p. 105.

Heilipus championi, nom. nov., for *H. trifasciatus*, Champ., 1902, *nec* F., 1787.

(*Coptorhamphus*, Woll., 1873) was described as a Cossonine, but actually belongs to the Hylobiinæ, and is a synonym of *Seleuca*, Pasc., 1871.

Seleuca (*linearis*, Mshl., 1926) = (*Coptorhamphus*) *strangulatus*, Woll., 1873.

(*Tiphaura*, Pasc., 1871) = *Spermologus*, Schh., 1843.

Spermologus (*breviscapus*, Mshl., 1925) = (*Tiphaura*) *funesta*, Pasc., 1871.

Develomus (*ciliatus*, Hust., 1924) = *plagiatus*, Fhs., 1845.

D. (*maynei*, Hust., 1924) = *subvittatus*, Fst., 1898, ♂.

D. (*callosus*, Hust., 1924) = *kamerunicus*, Fst., 1898, ♂.

D. (*congoanus*, Hust., 1924) = *kamerunicus*, Fst., ♀.

Apion (*cingalense*, Walk., 1859, *singhalensis*, Hllr., 1901, *shingalense*, Wagn., 1910) = *ceylonicum*, Gerst., 1854.

Echinapoderus kilimanus, Auriv., 1910, is not a synonym of *horridus*, Boh., but a distinct species (types compared).

Echinapoderus (*schröderi*, Voss, 1926) = *horridus*, Boh., 1845.

Euops (*nietneri*, Jek., 1860) = (*Rhynchites*) *suffundens*, Walk., 1859.

Alcides (*carbonarius*, Pasc., 1888) = *saundersi*, Pasc., 1870.

Alcides (*profluens*, Pasc., 1885) = *australis*, Boisd., 1835.

Alcides simus, Chev., 1881. On examining Chevrolat's collection recently at Stockholm, I found that the type of this species bears a small white label "*A. simus*, Ch.," in Chevrolat's writing, and also a large blue label bearing the name *A. orientalis*, Chev. These blue labels were never placed on the pin of the specimen by Chevrolat, but inserted with a separate pin below the row of specimens, and it is clear that several blue labels have been misplaced by someone in this box. A specimen, which from the description is obviously *A. orientalis*, Chev., bears the blue label of *erythropterus*, Chev., whereas five specimens that are clearly *erythropterus* have no label at all.

Alcides (*simus*, Chev., 1881) is the ♀ of *latefasciatus*, Chev., 1881.

Alcides (*maynei*, Hust., 1924) = *lixiformis*, Mshl., 1920.

Acicnemis (*arcuferus*, Chev., 1878) = (*Camptorrhinus*) *reversus*, Walk., 1859.

Acicnemis (*dohrni*, Huben., 1917) = *frenata*, Pasc., 1872.

Acicnemis **stilata**, nom. nov., for *frenata*, Huben., *nec* Pasc.

Acicnemis triangulum (Pasc.), Huben. (Arch. Naturg. lxxxiii. A. 8, pp. 105, 124), is clearly quite distinct from *Semelima triangulum*, Pasc., and the supposed errors in Pascoe's figure pointed out by Hubenthal are merely due to the fact that the latter author had misidentified the species ; his description appears to apply sufficiently well to *peduncularis*, Pasc., which he also failed to determine correctly (*op. cit.* pp. 105, 127).

Acicnemis falsa, nom. nov., for *peduncularis,* Huben., *nec* Pasc.

(*Neiphagus,* Pasc., 1886) = *Tetracyphus,* Chev., 1881.

(*N. fascicularis,* Pasc.) = *T. odontomus,* Chev.

(*Desmidophorus*) *discriminans* and *communicans,* Walk., 1859, belong to the genus *Amphialus,* Pasc., 1883.

(*Desmidophorus*) *fasciculaticollis,* Walk., 1859, is a *Cryptorrhynchus,* Ill.

(*Cryptorrhynchus*) *vexatus,* Walk., 1859, is a *Niphades,* Pasc.

(*Cryptorrhynchus*) *notabilis,* Walk., 1859, is a *Camptorrhinus,* Schh.

(*Cryptorrhynchus*) *assimilans* and *declaratus,* Walk., 1859, belong to *Mecistocerus,* Fvl.

Cryptorrhynchus (*ineffectus,* Walk., 1859) = *mangiferæ,* F., 1775.

Mecopus (*ludovici,* Hllr., 1893) = *serrirostris,* Pasc., 1871.

Mecopus helleri, nom. nov., for *serrirostris,* Hllr., *nec* Pasc. (Abh. Dresden Mus. 1892/93, no. 2, 1893, p. 16).

(*Baris*) *lineolatus,* Auriv., 1910, belongs to the Menemachinæ and in spite of its unusual spined tibiæ may be placed in *Hoplitopales,* Schh.

(*Eodinus,* Fst., 1898) = *Apotomorrhinus,* Boh., 1844.

(*E. fuscus,* Fst.) = *A. cribratus,* Boh.

(*Apotomorrhinus albo-ater,* Walk., 1859) = *Balaninus c-album,* F., 1798.

(*Apotomorrhinus*) *signatus,* Walk., 1859, is a *Baris.*

(*Mecinus? relictus,* Walk., 1859) is a rubbed specimen of *Baris signata,* Walk., 1859.

(*Sphenophorus*) *panops,* Walk., 1859, is a *Phylaitis,* Pasc.

(*Sphenophorus glabridiscus,* Walk., 1859) = *Odoiporus longicollis,* Oliv., 1807.

(*Sphenophorus cribricollis,* Walk., 1859) = *Cosmopolites sordidus,* Germ., 1824.

(*Sphenophorus exquisitus*, Walk., 1859) = *Myocalandra exarata*, Boh., 1837.

Omotemnus (*ceylanensis*, Roel., 1876) = (*Rhynchophorus*) *introducens*, Walk., 1859.

Sipalus (*tinctus*, Walk., 1859) = *hypocrita*, Boh., 1845.

(*Calandra porcata*, Pasc., 1885) = *Myocalandra exarata*, Boh., 1837.

(*Cossonus quadrimacula*, Walk., 1859) = *Calandra oryzæ*, L.

Psilosomus (*opacus*, Woll., 1873) = (*Cossonus*?) *hebes*, Walk., 1859.

LIX.—*On some new Chimæroid Fishes from Tertiary Formations.* By Sir A. Smith Woodward, LL.D., F.R.S., and Errol I. White, Ph.D., F.G.S.

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The remains of Chimæroid fishes belonging to living genera are rare as fossils, and the discovery of seven additional well-preserved teeth, belonging to three new species, is accordingly of interest.

Chimæra eocenica, sp. n. (Figs. 1–2.)

Specific Characters.—Palatine teeth attaining a length of at least 2·5 cm., much laterally compressed to form a sharp cutting-edge; tritors small, the anterior being subdivided into six or more small components, the posterior much reduced in size, the median absent, and the outer forming a thread-like band along the cutting-edge.

Mandibular tooth laterally compressed and trenchant with outer tritor as in palatine tooth; anterior and median tritors of small size.

Material.—The holotype, a left palatine tooth (Brit. Mus. P. 14762); referred specimen, a left mandibular tooth (Brit. Mus. P. 12345).

Form. and Loc.—Oldhaven Beds (L. Ypresian): Upnor, North Kent (Palatine tooth). Barton Beds: Barton, Hants (Mandibular tooth).

Remarks.—The surface of the palatine tooth on the outside has very largely disappeared, and the outer posterior extremity is broken away. This tooth is so much flattened that the oral surface (fig. 1, *P.T.–T.–O.* approximately) and the post-oral surface (*P.T.–T.–B.*) are very nearly in one plane, while the symphysial surface (*A.–B.*) is narrow and straight. The same features characterize the mandibular tooth (fig. 2), which, however, is more nearly complete, and shows a slight but distinct thickening on the outer face immediately below the oral margin (occupied by the thread-like outer tritor, *O.–T.*).

In the formation of a fine cutting-edge reinforced by the elongated outer tritors, and the consequent atrophy of the other tritors, these teeth approach the condition observed in the Rupelian genus *Amylodon*, Storms (1895, p. 71, pl. vi. figs. 11–12), and the Recent *Rhinochimæra*, Garman (1904, pl. v. figs. 1–2), and are thus distinguished from all other species of *Chimæra*, living and fossil. With this new species we have now an almost complete series of Chimæroids showing the transition from a purely crushing dentition (of which *Harriotta*, *Callorhynchus*, and *Chimæra anomala*, sp. n., *infra*, are extreme types) to a purely shearing dentition (*Amylodon*, *Rhinochimæra*), illustrating the diversity of the food and habits of these fishes. Although examples of most stages between one type of dentition and the other are to be seen among living Chimæroids (see B. Dean, 1906, p. 122, figs. 95–103), it seems certain that any change in dentition during the Tertiary era was from the crushing form to the shearing, and not reversely; for the Mesozoic Chimæroids and their allies had, without exception, a crushing dentition well developed, and no such intermediate form as *Chimæra eocenica* has been found in Mesozoic strata. Moreover, this intermediate form is found just where it would be expected in those circumstances, at the base of the Tertiary. The shearing dentition of *Rhinochimæra* (which is probably identical with the Oligocene genus *Amylodon*) is therefore not primitive, as

Fig. 1.

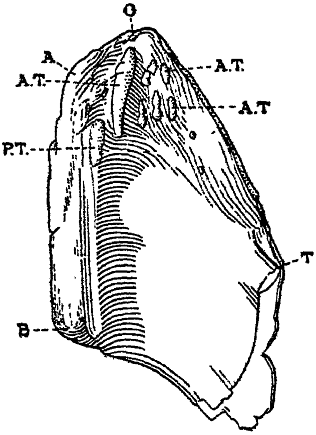
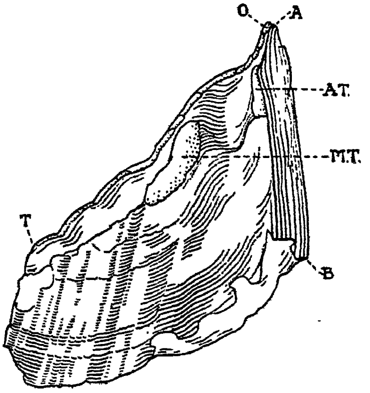


Fig. 2.



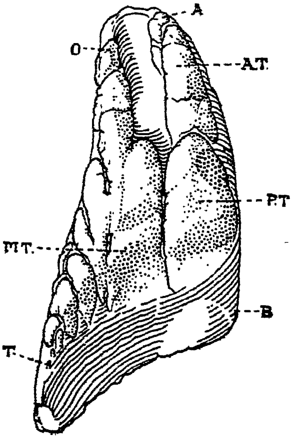
Chimæra eocenica, sp. n.

Fig. 1.—The holotype, a left palatine tooth. Oldhaven Beds: Upnor, North Kent. Oral view. (P. 14762. × 2.)

Fig. 2.—Left mandibular tooth. Barton Beds: Barton, Hampshire. Oral view. (P. 12345. × 2.) *A–B*=symphysial face; *A.T.*=anterior inner tritor; *M.T.*=median tritor; *O.–T.*=outer tritors; *P.T.*= posterior inner tritor.

Garman (1904, p. 254) suggests, and its similarity to that of the Devonian Ptyctodont *Rhynchodus* is deceptive. It is interesting to note that Garman himself, in the same paper (1904, p. 258), has made the suggestion that among Chimæroids there has been a tendency for the tritors to move forward with a corresponding diminution in the tritoral area (e. g., *C. affinis*, Capello, and *C. colliei*, Lay & Bennett) to form a cutting-beak, and that this condition arises through teeth such as those of the adult *Callorhynchus*, with wide tritors seated far back, from a tritorless type similar to that of the juvenile *Callorhynchus* and *Harriotta* (see B. Dean, 1906, p. 125, figs. 107–109). But, as Dean (1906, p. 126, footnote) has pointed out, no fossil member of this subclass had teeth without tritors; and, in any case, the type of shearing dentition which the true Chimæras, such as *C. colliei*, are evolving is very different from that of *Rhinochimæra*, for they show no lengthening of the outer tritors to reinforce the developing cutting-edge at the expense of the median and inner tritors; but, on the contrary, the median and inner tritors are preserved in part and move forward to serve the same purpose, and it is the outer tritors that have disappeared.

Fig. 3.



Chimæra anomala, sp. n.

The holotype, a right palatine tooth. Miocene (?): Victoria, Australia. Oral view. (P. 9732. Nat. size.) Lettering as in figs. 1–2.

Chimæra anomala, sp. n. (Fig. 3.)

Specific Characters.—Palatine tooth robust, attaining a length of at least 6·0 cm.; tritors unusually extensive, covering nearly all the oral face; posterior inner and median tritors of about equal size, the latter in part merged with the relatively large and irregular outer tritors.

Material.—The unique holotype, a right palatine tooth (Brit. Mus. P. 9732).

Form. and Loc.—Labelled "Miocene: Victoria, Australia" (probably from the Kalimnan (Pliocene) of Beaumaris Bay, near Melbourne).

Remarks.—In size this specimen far exceeds the teeth of any *Chimæra,* living or fossil, and represents a fish approximately 230 cm. in length. The great extent of the tritors renders this species easily separable from the others, of which four are found fossil: *C. eocenica,* sp. n., described above; *C. javana,* K. Martin (1883, p. 30, pl. ii. figs. 25, 26), a species based on small teeth from the Tertiary of Java; *C. gosseleti* (T. C. Winkler—see M. Leriche, 1910, p. 302, text-figs. 97, 98, pl. xix. figs. 46–56) from the Oligocene of Belgium; and *C. pliocenica,* A. S. Woodward (1891, p. 91, pl. i. fig. 15), founded on a palatine tooth from the Pliocene of Tuscany closely resembling those of the living *C. phantasma,* Jordan & Snyder (*cf.* B. Dean, 1906, p. 122, fig. 97).

Callorhynchus crassus, sp. n. (Figs. 4 *a–b* & 5.)

Specific Characters.—A comparatively large species, the mandibular tooth sometimes measuring 6 cm. from the middle of the symphysial border to the extremity of the post-oral margin. Mandibular tooth with beak more prominent than usual; median tritor small but stout, nearly in the middle of the oral face; a very small posterior outer tritor at the post-oral margin. Palatine tooth with tritor confined to hinder portion (as in the existing *C. tritoris,* S. Garman, 1904, pl. vi. fig. 9).

Material.—The holotype, a left mandibular tooth (Brit. Mus. P. 9093); an imperfect right mandibular tooth (Brit. Mus. P. 9828); and two portions of palatine teeth (Brit. Mus. P. 9094, P. 9094 *a*).

Form. and Loc.—Patagonian Formation: Santa Cruz, Argentine Republic.

Remarks.—The holotype is shown of the natural size from the inner, or oral, aspect (fig. 4 *a*) and the symphysial aspect (fig. 4 *b*). The outer face is broken away below the thickened band that runs under the oral margin, and the median tritor is represented for the most part by a cavity. The right mandibular tooth is little more than half the size of the holotype, and it lacks the (posterior) outer tritor and the whole of the oral and post-oral margins. Of the palatine teeth mere fragments remain, but they show the backward position of the tritor (fig. 5), part of the symphysis, and, in the one specimen, P. 9094, part of the thickened band above the oral margin.

As noted in the diagnosis, this species approaches most nearly the living *C. tritoris,* Garman, in the position of the palatine tritor, but the teeth are far wider than in that form. Only one other fossil species has been recorded, *C. hectori,* E. T. Newton (1876, p. 329, pl. xxi. figs. 6–9), from the Senonian of New Zealand, but in that the palatine tritor is produced forward into two

Fig. 4.

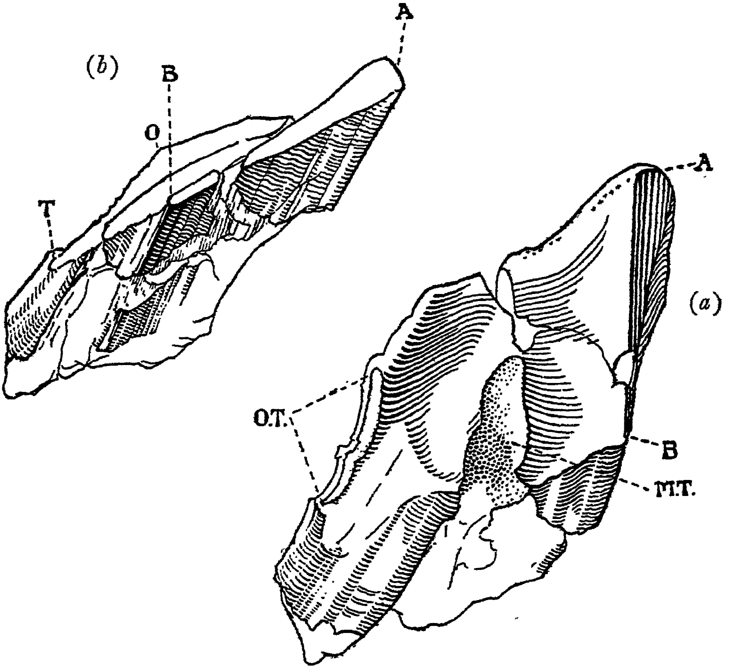
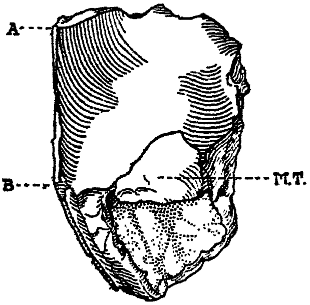


Fig. 5.



Callorhynchus crassus, sp. n.

Fig. 4.—The holotype, a left mandibular tooth. Patagonian Formation: Santa Cruz, Argentine Republic. (*a*) Oral view. (*b*) Symphysial view. (P. 9093. Nat. size.) Lettering as in figs. 1–2.

Fig. 5.—Fragmentary left palatine tooth. Patagonian Formation: Santa Cruz, Argentine Republic. Oral view. (P. 9094. Nat. size.) Lettering as in figs. 1–2.

long horns, rather after the manner of the teeth in the living *C. capensis*, Duméril: indeed, Garman (1904, p. 257) considers that these two species are identical, but, apart from the extreme unlikelihood of such specific longevity among fishes, the Cretaceous tooth, having the two elongated but unequal horns of the tritor fused behind, differs as much from that of *C. capensis*, in which (according to Garman's figure, 1904, pl. vi. fig. 5) the tritor is divided into two completely separate and equal halves, as from the Recent *C. callorhynchus* (Linnæus), with the palatine tritor produced into two horns of moderate length fused behind. The fossil, in fact, is intermediate between the two in respect of the palatine teeth.

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LX.—*On a new Homalopterid Fish from Annam.* By SUNDER LAL HORA, D.Sc., F.R.S.E., F.L.S., F.Z.S., F.A.S.B., Zoological Survey of India, Calcutta.

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[Plate XV.]

WHILE I was engaged in examining the material of Homalopterid fishes in the British Museum (Natural History) in 1928, Mr. J. R. Norman very kindly entrusted to me for examination and description a small collection of the family from Annam made by the Delacour-Lowe Expedition. Among this lot I found a specimen which represents a new species of the hitherto monotypic genus *Parhomaloptera*. Mr. Norman lent me the specimen for the purpose of drawing etc., and for this my best thanks are due to him.

The Homalopterid fishes constitute a remarkable family of torrent-inhabiting loaches, and, though its specialised members are very characteristic and easily distinguishable, its lower limits are not well defined. The family is characterized, among other things, by the position and structure of its paired fins, which are horizontally placed and are provided with a number of "simple rays." On this character two main lines of evolution, each with a number of side branches, can be recognised among the Homalopteridæ. The simple rays are broadened and segmented, at least for a considerable portion towards their distal ends, and are provided with pads of skin on the ventral aspect for adhesive purposes. These rays are of two kinds. In *Balitora brucei,* for example, they are produced by the coalescence of the branches of an ordinary ray, whereas in *Gastromyzon borneensis* the two main branches of an ordinary ray become specially thickened and modified and superficially each branch appears as an unbranched ray. In my opinion this character is of considerable value *, and should be utilized in dividing the genera of the family into two groups.

The genus *Parhomaloptera* belongs to the group in which there is only one undivided ray in the paired fins, but so far no consideration whatsoever seems to have been paid to this character in defining the genus. Its author (Vaillant) and subsequent workers have distinguished it from *Homaloptera* by the presence of four pairs of barbels, three pairs of which are situated in a horseshoe-shaped groove before the mouth. A very small barbel at each corner of the mouth represents the fourth pair. I have examined a number of specimens of *Parhomaloptera microstoma* (Blgr.) and have found that the barbels at the corners of the mouth do not form a constant feature of the species. In the type-specimen (Brit. Mus.) there are only six barbels, and the lips are continuous at the corners of the mouth. Boulenger †, in his description of the species, gives no indication as to the number of barbels, and simply remarks "barbels very short, on the lower surface of the snout, near the mouth." In a small specimen of *Parhomaloptera obscura,* Vaill., in the Paris Museum, about 60 mm. in length, the barbels are six in number as in the type-specimen. In the type-series of *Parhomaloptera obscura,* in the Leyden Museum, there are five specimens and all of them possess eight barbels. The lips are widely interrupted, and at the corners of the mouth there are two fleshy lobes which are produced into small barbel-like extensions. In my opinion these fleshy lobes are the remnants of the once continuous lips, and that is why, in the specimens with continuous lips, there are no barbels at the corners of the mouth. In view of what has been said above, the genus *Parhomaloptera* may be redefined as follows:—

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* In Phil. Trans. Roy. Soc. London, (B) 1930, I have referred briefly to the divergent modifications of the anterior rays in the paired fins of the Homalopteridæ, and have discussed their probable origin and significance.

† Boulenger, Ann. & Mag. Nat. Hist. (7) iv. p. 228 (1890).

The genus *Parhomaloptera* comprises small, loach-like, greatly depressed fishes, which are provided with only one undivided ray in the paired fins, with a horseshoe-shaped groove in front of the mouth, with six small barbels on the ventral surface of the snout and with a small lunate mouth-opening. The gill-openings are fairly wide, and extend to the ventral surface for a short distance. The lips are either continuous at the corners of the mouth or, when interrupted, are represented by a papilla-like growth at each corner.

Parhomaloptera normani, sp. n. (Pl. XV.)

D. 2/8; A. 1/5; P. 1/16; V. 1/10; C. 18.

In *Parhomaloptera normani* the dorsal profile is slightly arched, and the ventral profile is straight and horizontal throughout. The head and body are greatly depressed, but the tail-region is subcylindrical and whip-like in appearance. The head is broadly conical and its length is contained 5·1 times in the total length without the caudal. The greatest width of the head is about two-thirds, and its height is about two-fifths of its length. The height of the body is about one-half of the length of the head. The snout is more than half the length of the head, and consequently the eyes are situated entirely in the posterior half of the head. The eyes are dorso-lateral in position and are not visible from the ventral surface; the superior margin of the eye is raised slightly above the dorsal profile of the head. The diameter of the eye is contained 4·3 times in the length of the head, 2·3 times in the length of the snout, and 1·3 times in the interorbital width. The nostril is situated immediately in front of the eye, and is represented by a circular depression which is covered by a thin membrane anteriorly, and in the posterior region there is a round opening. The mouth is small, lunate, and slit-like; it is situated considerably behind the tip of the snout, and is bordered by continuous lips. In front of the anterior lip there is a horseshoe-shaped depression. There are six small barbels. The gill-openings extend to the ventral surface for a short distance. The body is covered with thin, closely adhering, small scales and the lateral line is complete.

The origin of the dorsal fin is in advance of the ventral, and its commencement is much nearer the tip of the snout than the base of the caudal; its second undivided ray is the longest and is equal to the length of the head. The pectoral is fan-shaped and is considerably longer than the head; it is separated from the ventral by a distance equal to two-fifths of its length. The ventral is shorter than the pectoral, but is almost as long as the head; it extends as far back as the anus. Both the paired fins are provided with a single unbranched ray. The anal fin is small and does not reach the base of the caudal, which is remarkably long and narrow. The lower lobe of the caudal is considerably longer than the upper; a number of outer rays of both the lobes are fused together to form bony plates, which enable the caudal fin to be effectively used, like an oar, for progression in swift currents. Of the eighteen rays in the caudal fin, four upper are fully coalesced, the following ray is partly fused, and then there are five free rays. Of the remaining eight rays, six lower ones are completely fused, while the other two are united with these along their proximal halves. Similar modifications of the rays in the caudal fin are found in *Parhomaloptera microstoma* and several other Homalopterid fishes.

The dorsal surface of the head and body in front of the dorsal fin is irregularly mottled with black markings, but behind the origin of the dorsal it is provided with four short bands which extend on the sides up to the lateral line. Below the lateral line there are a number of short vertical bands. The paired fins are provided with a number of black blotches irregularly distributed, whereas the lower lobe of the caudal fin is provided with six or seven short, vertical, black bands. The ventral surface is without any markings.

The type-specimen is preserved in the British Museum (Natural History). It was obtained at Kontum, in Annam, by the Delacour-Lowe Expedition.

Remarks.—The genus *Parhomaloptera* has hitherto been known only from rivers in Borneo. The new species is abundantly distinct from *P. microstoma* both in the shape and proportions of its head, in the structure of the horse-shoe-shaped groove in front of the mouth and its relation with regard to the position of the barbels. In *P. normani* the eyes are more prominent and are raised slightly above the dorsal profile of the head.

I have great pleasure in associating the new fish with the name of Mr. J. R. Norman.

EXPLANATION OF PLATE XV.

Parhomaloptera normani, sp. n.

Fig. 1. Lateral view of type-specimen, ×1½.
Fig. 2. Ventral view of same, ×1½.
Fig. 3. Ventral surface of head and anterior part of body, ×3.
Fig. 4. Ventral surface of pectoral fin, ×3.

LXI.—Leocomia cinchonæ, *sp. n.*, *a new Cercopid from Jamaica.*

By ALAN PICKLES, B.Sc., A.I.C.T.A. (Entomologist to the Trinidad Froghopper Investigation Committee).

Description of Adult.—A tawny species with the head and pronotum somewhat darker. Head as wide as the pronotum, vertex strongly produced in front of the eyes, with a slightly thickened margin not quite in line with the eyes. Ocelli nearer to each other than to the eyes, with a slight elevation between them; vertex otherwise flat. Tylus distinct, interrupting slightly the parabolic outline of the head. Frons flat on the disc, with five ridges on each side more or less distinct. Pronotum twice as broad as medianly long, convex, with a minute lens-shaped depression on each side of the median line, just behind the anterior margin; broadly rounding in front, obtusely excavated behind. Scutellum once and a half as long as the pronotum, with incurved sides. Tegmina coriaceous, greatest width two-thirds of length, with abundant short pubescence; venation very obscure. Venation of hind wing normal. Hind tibiæ with a short stout spine at the base and one, much longer, somewhat distal to the middle.

Colour pale brown, head and pronotum somewhat darker; tegmina and scutellum with a short pale pubescence; eyes, tip of rostrum, claws, and hind tibial spurs black.

Length 5·3 mm. (holotype).

Host: *Miconia rubens*, Naud. (det. J. G. Myers).

Described from five specimens (all females) obtained by breeding from nymphal material, collected at Cinchona Plantation, Jamaica, January 29th, 1930.

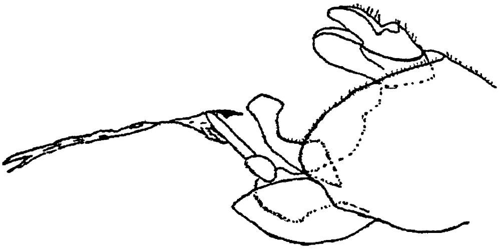
A single male specimen was reared, but was so badly damaged as to be useless for description except of the genitalia (fig. 1). The male genitalia present some similarity to those described by Myers for *L. collina*; the proximal portion of the ædeagus in *L. cinchonæ*, however, is cylindrical and the barbs at the base of the membranous distal part are of different form.

This would appear to be the largest species of the genus yet described: *L. grisea*, M. & B., and *L. fulva*, M. & B., are the only other species exceeding 5 mm. in length.

This species differs from the genotype, as do the Cuban representatives (M. & B.), in having a prominent spine near the middle of the hind tibiæ.

From the descriptions, it differs from *L. grisea*, M. & B., in having the middle tibial spine much longer than the basal one and in colour; from *L. balloui*, M. & B., in size, colour, and the absence of prominent venation of the tegmina; from *L. nagua*, M. & B., in size, absence of tegminal markings, and position of the ocelli; from *L. mæstralis*, M. & B., in size, shape of vertex, obtuse excavation of the hind margin of the pronotum, and the obscurity of tegminal venation; from *L. pileæ*, M. & B., in size and colour; from *L. fulva*, M. & B., in having curved margins to the head and in the absence of a median carina to the pronotum; and, lastly, from *L. collina*, Myers, in size, in having the head as wide as the pronotum, and in the structure of the ædeagus.

Fig. 1.



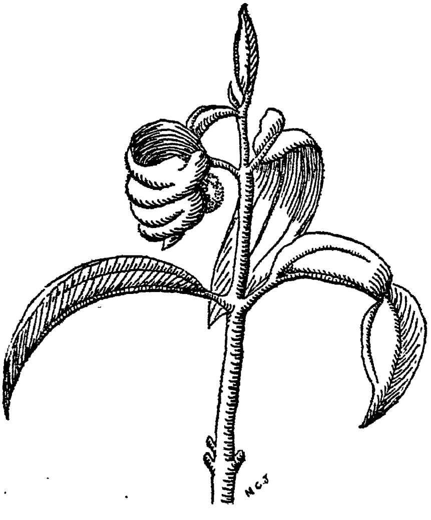
Male genitalia of *Leocomia cinchonæ*.

Biology.—This species was encountered in the Blue Mountains of Jamaica at an altitude of 4900–5000 feet. A small Melastomaceous plant, *Miconia rubens*, Naud., was observed to be heavily infested with spittle, which was most abundant on the younger leaves. In a large proportion of cases, affected plants show very characteristic pathological symptoms. The leaves in such cases were yellow in colour and much distorted, often curling spirally on themselves to form a pseudo-gall (fig. 2). While such pseudo-galls were occasionally found without nymphs, in all cases there was evidence, in the shape of exuviæ or dried spittle, that nymphs had been feeding there, and there seems to be no doubt that this condition arises through the feeding activities of the nymph. This is in contrast to the sugar-cane froghopper, *Tomaspis saccharina*, Dist., in which nymphal feeding seems to have little effect upon the host, but where the feeding activities of the adults have most pronounced blighting properties.

The eggs are relatively large white objects, measuring ·81 mm. in length and ·15 mm. in diameter. Each has the form of a cylinder with rounded ends; there is no indication of one end being more pointed than another.

In contradistinction to the usual habit in Cercopidæ, the eggs are not inserted in the tissues of the host, but are to be found on the lower surface of the leaf near the base, in the angle between the midrib and a large longitudinal vein. Actual oviposition was not observed, but the evidence shows that the adult female seeks out the spittle-mass of nymphs of her own species in which to oviposit. Indeed, the eggs can only be discovered by scraping away spittle from the base of the leaf-blade, when a batch of eggs is often exposed. There may be as many as twenty-seven eggs in a batch, laid without much regard to order and fastened to the leaf-surface by some adhesive.

Fig. 2.



An infested shoot of *Miconia rubens*.

The populations of three of the spittle-masses examined which contained eggs were as follows:—

(1) 27 healthy unhatched eggs; 4 egg-shells normally hatched; 5 first instar nymphs; 1 second instar nymph; 2 third instar nymphs and 1 fourth instar nymph.

(2) 7 healthy unhatched eggs; 4 shells normally hatched; 2 first instar nymphs.

(3) 7 healthy unhatched eggs; exuviæ of 4 fourth instar nymphs.

No eggs were ever found apart from spittle-masses, and even empty shells were usually accompanied by exuviæ in abundance.

During the course of incubation, a "hatching-lid" is developed; this is opaque white in colour.

The nymphs at all stages are white in colour, with a slight greenish tinge, probably due to chlorophyll in the food. The wing-rudiments agree with the general body-colour and are not darker as in most Cercopidæ.

The spittle produced by this species is close in texture, never watery as in *Clastoptera*, and dries to a thin homogeneous film.

One hundred and thirty nymphs of all stages were dissected and examined for parasites, but without success. Eggs kept under observation for about a week also failed to show signs of parasitism.

LXII.—*On a new Species of the Moniligastrid Genus* Desmogaster *from China.* By G. E. Gates, Judson College, Rangoon, Burma.

The primitive Moniligastrid stock is supposed (Stephenson, 1930, p. 811) to have arisen somewhere in the ancient Gondwanaland, where it gave rise to two branches. One of these branches, the Syngenodrilinæ, penetrated into and obtained a footing in tropical East Africa. The other branch, the Moniligastrinæ, reached and has retained a hold on the Burmese and East Indian regions. The genus *Desmogaster* is regarded as the most archaic genus of the Oriental portion of the family, and is supposed to represent to-day the ancestral condition from which other genera of the eastern subfamily have been derived. Opportunities for the study of this genus have been few—the number of species described is small and the records of their distribution are limited to one or two localities. Of the six species hitherto described, two (*D. albalabia*, Gates, 1930, and *D. doriæ*, Rosa, 1890) occur in the hills of the Toungoo district, Burma; two species, *D. schildi*, Rosa, 1897, and *D. horsti*, Beddard, 1893, were found in Sumatra (the first from Korintji, Serapai, and Pahang, and the second from Berg Singalang); while *D. giardi*, Horst, 1899, and *D. büttikoferi*, Michaelsen, 1922, were collected at Nanga Raoen in Borneo.

It is, therefore, of some interest to be able to report the probable occurrence of another species of the genus from China, from a locality at some distance from the previously known *Desmogaster* areas. The word "probable" is used because a more definite statement cannot be made at present as to the exact locus of derivation of the specimen involved. The individual worm in question, together with several immature specimens of *Pheretima* labelled *P. hupehensis* and several specimens of *Allolobophora caliginosa trapezoides*, arrived at this laboratory some months ago in a package bearing Chinese postage-stamps. The address of the sender had become moistened, and being in ink had become illegible. Dr. N. Gist Gee had written twice that he had requested the Soochow Biological Supply service to send specimens of the earthworms of the region around Soochow. Although I have been unable to obtain confirmation of a shipment from Soochow, it seems more than likely that the shipment in question is from the Company mentioned, and that the worms are from the vicinity of Soochow.

Desmogaster sinensis, sp. n.

Description of the type-specimen.—External characteristics. Length 307 mm. Diameter in the thickest portion 11 mm.

Annular furrows are of three sorts:—(1) Deep clear-cut grooves, all of which are regarded, in conformity with previous practice, as intersegmental furrows; (2) the secondary furrows proper; and (3) slighter tertiary furrows. Segment iii. has a single, faint, secondary furrow clearly visible on the dorsal surface only; iv. has a single, slight, secondary furrow; v. has a single, slightly deeper, secondary furrow; vi. has a still deeper secondary furrow in the middle of the segment; segment vii. and each succeeding segment, including xiii., have a conspicuous secondary furrow in the middle of each segment as well a tertiary furrow on each anterior and posterior half of the segment marked off by the secondary furrow. Segments i. and ii. are of about the same length antero-posteriorly, and together are not quite twice the length of iii. From iii. on, the segmental length increases gradually until the maximum is reached at segment ix. Passing posteriorly from segment x. the length gradually decreases.

The prostomium is withdrawn into the buccal cavity.

Colour light brownish dorsally, probably somewhat bleached by action of the preservative; ventrally greyish.

Setæ have not been seen, although they have been looked for with the binocular dissecting microscope. A portion of the posterior end appears to have been regenerated. On such regenerated portions setæ are usually clearly visible, sometimes more so than on the older unregenerated portion, but there is no more indication of the presence of setæ on this posterior portion than anteriorly.

The clitellum is not clearly demarcated dorsally, but is indicated ventrally by the presence of brown pigment on the ventral surface of segments x.-xv.

In each of the two intersegmental furrows 7/8 and 8/9, about 6 mm. apart, are a pair of small, rounded, slightly protuberant tubercles. On the tip of each tubercle is a spermathecal aperture.

The male pores are in 11/12 and 12/13, those of a pair about 4½ mm. apart, each pore located at the tip of a tubercle slightly smaller than the spermathecal porophore. The epidermis around the male porophores and on a narrow region on each side of the intersegmental furrows between the porophores is whitish and tumid, the swellings elongately dumb-bell-shaped.

The female pores are on the anterior half of segment xiv., in line with or very slightly internal to the male pores.

On the anterior borders of the segments near the intersegmental furrows are tiny, but readily visible, markings, which are presumably nephridiopores. The pore itself is a minute funnel-shaped depression in the epidermis with the margin of the depression partially or entirely encircled by a fine but evident yellowish line. Both pores of a segment may be ventral, dorsal, or lateral, or the pores may be asymmetrically placed. Thus, for example :—

On xvi. both pores are ventral in position, slightly external to the line of the male pores.
On xvii. the left pore is slightly external to the left pore on xvi., the right pore is dorsal.
On xviii. the right pore is ventral, the left pore is dorsal.
On xix. the right pore is ventral, the left pore dorsal.
On xx. the right pore is ventral, but internal to the right pore on xix., the left pore is lateral.
On xxi. the right pore is ventral, but external to the right pore of xix., the left pore is dorsal.
On xxii. both right and left pores are ventral.

Internal anatomy.—Assuming, in accordance with previous practice, that the spermathecæ are in segments viii. and ix., then septum 5/6 is present and thickened, 6/7, 7/8, 8/9, and 9/10 are much thickened, succeeding septa apparently all present but thin. Septum 4/5 appears to be present, as in *D. doriæ*, as a very thin transparent sheet attached peripherally to the anterior face of 5/6.

The last pair of hearts is in xi. The dorsal blood-vessel is double from 11/12 forwards.

The spermathecal ampulla is small relatively to the size of the worm and to the size of the ampullæ in the Burmese species of the genus, rounded, not flattened, slightly pear-shaped. The spermathecal duct may be said to be composed of three distinct regions :—(1) A narrow ental portion about 6 mm. long, which is loosely looped under the ampulla; (2) a thicker middle portion, fastened closely against the posterior face of the septum; this part of the spermathecal duct at first glance appears to pass straight down the septum to the bottom of the segment, but closer examination shows that the duct is folded into a series of very short, closely compacted, zig-zag loops; (3) a narrower parietal portion about 1 mm. in length, loose on the segmental floor, and passing into the integument without further looping or enlargement.

The testis-sacs are smallish rounded chambers high up on septa 10/11 and 11/12. The vas deferens of the right anterior testis-sac passes out through the bottom of the sac, through septum 10/11 into x., where it is thrown into a number of longish loops with the limbs of each loop pressed into close contact with each other. It then passes back through the septum into xi., where there are more loops of a similar sort, and finally appears to pass into the parietes at the anterior base of septum 11/12 without any trace of a prostate. In the ventralmost portion of segment xi. there is a considerable mass of tissue composed of diagonally placed sheets and muscular cords, which covers over the true parietal floor of the segment. When this tissue is dissected off, the vas deferens can be seen to pass into the centre of a whitish circular patch imbedded in the parietes. This circular patch is composed of a number of very short, erect, finger-like lobes, the inner ends of which pass into the parietal tissue around the base of the vas deferens. The vas passes through the lobes of the glandular mass and the integument to the porophore without appreciable signs of enlargement. The vas, when dissected out and straightened, but without stretching, is longer than 70 mm. The right posterior vas deferens is similarly arranged, but its relationships are with segments xi. and xii., instead of x. and xi. In or on each side of each testicular septum is an opaque, whitish, duct-like cord, which passes up towards the testis-sac as if it were a vas deferens, but instead of passing into the testis-sac passes on upwards and slightly internal to the testis-sac. It has not been possible to trace this cord at either end. It is presumably the same structure as that in *D. doriæ*, which Rosa considered a blood-vessel.

Septa 12/13 and 13/14 are present and attached normally to the parietes—at least laterally. Internally these septa come into contact on each side of the alimentary canal, and fuse in such a way as to form a U-shaped ovarian chamber inverted over the œsophagus. The space within the ovarian chamber is filled by a mass of dense whitish tissue, firmly attached to the inner walls of the limbs of the U, and by the pair of large nephridia. The œsophagus and dorsal blood-vessel appear to lie within periœsophageal annulus between the limbs of the U, while the nerve-cord is contained within a mid-ventral chamber. Small blunt ovisacs project from the posterior face of 13/14 into xiv. The walls of these sacs are thick; the lumen is small and practically empty.

The œsophagus in xiv. is bent back on itself in the form of a letter S, the ventral portion of the S passing anteriorly, and the dorsal portion posteriorly. Just before passing through 14/15 the œsophageal wall is thickened and whitened, and doubtless represents a rudimentary gizzard. There are three well-developed gizzards, probably in segments xv., xvi., and xvii., but the relationships of the organs in this region are confused by the contacts of the septa involved and the presence of extra septa-like sheets of tissue.

Distribution.—Probably from the vicinity of Soochow, China.

Remarks.—*D. sinensis* appears to be more closely related to the Burmese species of the genus than to any of the East Indian forms at present known. It has the peculiar glandular arrangement around the ectal end of the vas deferens together with the absence of an ectal thickening of the vas into an elongate prostate hitherto characteristic of *D. albalabia* only. The number and location of the gizzards are also similar to those of the gizzards in *D. albalabia*. In size and coloration *D. sinensis* more closely resembles *D. doriæ* than the much smaller *D. albalabia*. Unlike both Burmese species the vas deferens of *D. sinensis* is not imbedded within the parietal wall before reaching the point of final exit through the integument. The rounded shape of the spermathecal ampulla and its size are more like the shape and size of the ampulla of the Burmese species of *Drawida* than the flattened large ampullæ of the Burmese Desmogasters.

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LXIII.—*Three new Reptiles from Southern Arabia.*
By H. W. Parker, B.A.

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The British Museum, conjointly with the Bombay Natural History Society, has recently received a small, but very interesting, collection of reptiles from the great desert of Rub'al Khali, inland from Dho far, S. Arabia, collected by Mr. Bertram Thomas and Ali Muhammad. The majority of the species represented in the collection have already been recorded either from the Hadramaut or Muscat, so that there seems to be no necessity for the publication of a detailed list. But, in addition to the two lizards here described as new, mention may be made of two specimens of *Uromastix microlepis*, Blanford, one of *Phrynocephalus maculatus*, Anderson, and six of *Agama jayakari*, Anderson. These were collected in the Hadramaut, and none of the species appear to have been previously recorded from any locality so far south. The author has taken advantage of this opportunity to describe also a southern Arabian snake of the genus *Boœdon*, and to incorporate some remarks on that genus.

Ceramodactylus major, sp. n.

Holotype a male, number 1930.6.30.1 in the British Museum, from Rub'al Khali, Hadramaut.

Head large, oviform; snout obtusely pointed, longer than the diameter of the orbit, as long as the distance between the eye and the ear; eye large, pupil vertical; ear-opening small, vertically elliptical. Body and limbs slender; fore limb, when adpressed, reaching well beyond the tip of the snout; hind limb reaching the axil. Head covered with juxtaposed, equal, subcircular, rugose granules; rostral subquadrangular, broader than high, with a median cleft above; nostril pierced in a pronounced swelling, which is followed by a concavity, and bounded by the rostral, first upper labial, and three nasals, the inner of which is separated from its fellow by a single enlarged scale; fourteen or fifteen upper, and thirteen lower labials; mental subquadrangular, as deep as broad; no chin-shields. Body covered with uniform, small, subimbricate, rugose granules above; ventrals similar to the dorsals, but smooth or only slightly rugose. Digits strongly depressed, with long lateral fringes; lower surfaces with small spinose scales arranged in seven to nine longitudinal series. Tail slender, tapering, compressed posteriorly, covered with subimbricate scales, which in front resemble those of the back but which become distinctly keeled and arranged in vertical series on the sides behind.

A pair of widely separated preanal pores and a group of about nine enlarged conical scales on each side of the base of the tail.

Whitish above, with an irregular, ill-defined, black reticulum; immaculate white beneath.

	mm.
Total length	152
Head	26
Width of head	21
Snout to vent	80
Fore limb	33
Hind limb	43

This species is allied to *C. doriæ*, Blanford, but differs in its larger size, longer snout, rugose scales, longer digital fringes, more numerous subdigital scales, and colour.

Uromastix thomasi, sp. n.

Holotype a male, number 1930.6.30.2 in the British Museum, from Bu Ju'ay (1470 ft.), Rub'al Khali, Hadramaut.

Anterior border of ear not denticulated; no spines on the back of the head and neck. Scales small, subimbricate. Seventeen or eighteen femoral and preanal pores on each side, forming a more or less continuous series; two smaller pores forming a second row immediately anterior to the central pair of preanal pores; a small group of callose scales on the extreme hinder part of the belly. Tail strongly depressed, very short, elliptical in outline, with regular transverse rows of enlarged scales which are feebly spinose mesially and more strongly so laterally; subcaudal scales smooth, two rows corresponding to one of the upper surface at the middle of the tail, more anteriorly, and only one posteriorly (last three annuli). Pale brown above, closely reticulated and marbled with darker; about five very indistinct indications of dusky cross-bars. Head with regular dark markings, as follows:—an indistinct vertical bar in front of the eye; another beneath the eye and extending well on to the lower lip; a diagonal bar from the posterior corner of the eye to the lower border of the ear, and a similar one from the supraocular region to the upper border of the ear; four streaks radiate from the occiput, increasing in width behind, the outer pair reaching the sides of the neck and the median pair the scapular region. Limbs with indefinite dusky cross-bars. Tail with six black spots arranged alternately in pairs and singly. Lower surfaces white, the chin and chest smudged with black.

	mm.
Total length	160
Snout to vent	125
Tail	35
Fore limb	33
Hind limb	58

The paratype, a male from Mutugtayg (1100 ft.), Rub'al Khali, in the collection of the Bombay Natural History Society, differs in some details. There is no second row of preanal pores, the callose ventrals are larger and more numerous, the dark markings of the head are very obscure, and there are no dark cross-bars on the body.

Length from snout to vent 133 mm.; tail 40 mm.

This species differs from all the other species of *Uromastix* (sensu stricto) in its short depressed tail, a character in which it closely resembles *Aporoscelis princeps*; it is clearly distinguished from the latter, however, in the possession of femoral and preanal pores and the much weaker spines of the tail.

Boœdon arabicus, sp. n.

Boodon lineatus (non Dum. & Bibr.), Boulenger, Ann. & Mag. Nat. Hist. (7) xvi. p. 180 (1905).

Holotype a female, number 1903.1.28.14 in the British Museum, from El Kubar, Amiri Country, S.W. Arabia, collected by Mr. G. W. Bury.

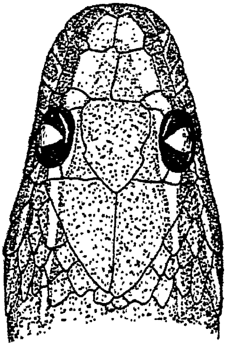
Eye moderate; rostral much broader than deep, visible from above; internasals much narrowed anteriorly, two-thirds the length of the præfrontals; frontal once and a quarter as long as broad, slightly shorter than its distance from the end of the snout, and shorter than the parietals, notched laterally. Loreal quadrangular, about 2½ times as long as deep, divided into two on the left side; two præoculars, the upper in contact with the frontal and the lower less than half the size of the upper; two postoculars; temporals 1+2; 9 upper labials, the fourth, fifth, and sixth entering the eye; four lower labials in contact with the anterior chin-shields, which are much longer than the posterior. Scales smooth, with apical pits, in thirty-one rows at the mid-body (formula 29–31–21); ventrals 246; anal entire; subcaudals divided, 48 + 1.

Uniform purplish brown above. Two light lines on each side of the head, the upper commencing on the internasals, where it is in contact with its fellow, and passing along the canthus rostralis and supraciliary edge to the hinder temporal region; the lower commences on the lower postocular and sixth upper labial, and runs to the angle of the mouth. Lower surfaces and upper labials yellowish white.

Total length 710 mm.; tail 88 mm.

The four paratypes, a female and a juvenile from the type-locality (B.M. 1903.6.26.29–30) and a juvenile from the Schaf Ravine, Upper Hushabi (B.M. 1903.3.6.17), all collected by Mr. Bury, and a juvenile from Dthala, Aden Hinterland (B.M. 1907.3.7.11), collected by Captain Ingram, show the following variation:—

The frontal may be as long as its distance from the end of the snout and is not notched laterally, the loreal is undivided in the three juveniles but divided on both sides in the female, and may be three times as long as deep; the anterior temporals may be 1 + 3, the upper labials eight in number, with only the fourth and fifth entering the eye, and there may be only three lower labials in contact with the anterior chin-shields. The dorsal lepidosis varies from 27–31–21 to 29–33–21; ventrals 229–250; subcaudals 48–52. The colour-pattern is almost constant, but the upper and the anterior lower labials may each have a central brown spot.



Boædon arabicus, sp. n.

Maximum length 750 mm.; tail 90 mm.

This species is closely allied to *B. lineatus*, Dum. & Bibr., but differs in the possession of two loreals or a single quadrangular shield, which is more than 2½ times as long as deep; the single loreal of *B. lineatus* is constantly subpentagonal, and is never 2½ times as long as deep. In addition, the præocular of *B. lineatus* is usually single, but if divided the lower shield is more than half the size of the upper, whereas in *B. arabicus* the lower is constantly very small.

Of the species hitherto referred to the genus *Boædon*, *B. infernalis*, Günther, as suggested by Hewitt [*], does not appear to be specifically distinct from *Lamprophis inornatus*, Dum. & Bibr. The dentition is that of a *Lamprophis*, so that, despite the fact that apical pits are present as in *Boædon* (though frequently very indistinct), it seems preferable to refer the species to the former genus.

There is also little doubt that *Boædon lemniscatus*, Dum. & Bibr., is conspecific with *Pseudoboodon gascæ*, Peracca; Abyssinian specimens which agree exactly with Duméril and Bibron's description are found to possess the labial pits of *Pseudoboodon*, and to lack apical pits. Since these two characters are not found in any other species of *Boædon*, and since, moreover, the maxillary diastema is very short, the dentition being intermediate between that of *Lamprophis* and *Boædon*, it is desirable to retain Peracca's genus, but the type-species must be known as *Pseudoboodon lemniscatus* (Dum. & Bibr.).

LXIV.—*Synonymic Notes on Australian* Acrididæ (*Orthoptera*). By B. P. Uvarov.

Austroicetes pusillus (Walk.).

1870. *Epacromia pusilla*, Walker, Cat. Derm. Salt. Brit. Mus. iv. p. 778.
1907. *Chortoicetes pusillulus*, Rehn, Bull. Amer. Mus. Nat. Hist. xxiii. p. 447 (*syn. nov.*).
1921. *Chortoicetes pusillula*, Sjöstedt, Acrid. Austr. p. 48.

The type of *E. pusilla*, Walk., agrees in all characters with Rehn's detailed description of *Ch. pusillulus*. Sjöstedt described *Ch. pusillus* as having the frontal costa flat, while in the type it is quite distinctly sulcate, just as it is described by Rehn. Sjöstedt's *pusilla* is, thus, obviously not the species called so by Walker, and I am able to check this my statement by the examination of some specimens in the British Museum named by Sjöstedt as *pusilla*, but clearly not conspecific with the type. The apex of the hind wings in the type of *pusilla* is scarcely infumate, and this, together with the structure of the frontal costa, makes a correct identification of the species with the aid of Sjöstedt's key impossible.

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[*] Rec. Albany Museum, ii. p. 264 (1912).

Pycnostictus seriatus, Sauss.

1921. *Chortoicetes marginalis*, Sjöstedt, Acrid. Austr. p. 49 (*syn. nov.*).

The type of *Ch. marginalis*, Sj., is but one of several specimens of *P. seriatus* from Kermannsburg, C. Australia, quite correctly recorded by himself elsewhere (*l. c.* p. 57).

Œdaleus australis, Sauss.

1884. *Œdaleus senegalensis*, var. *d*, Saussure, Prodr. Œdip. p. 117.
1888. *Œdaleus nigrofasciatus*, var. *australis*, Saussure, Addit. Prodr. Œdip. p. 41.
1903. ‖*Œdaleus senegalensis*, Froggatt (nec Krauss, 1877 !), Agric. Gaz. N. S. Wales, xiv. p. 1105, fig. 5.
1920. ‖*Œdaleus senegalensis*, Sjöstedt (nec Krauss !), Arkiv f. Zool. xii. no. 20, p. 11.
1920. *Œdaleus nigrofasciatus*, var. *australis*, Sjöstedt, Acrid. Austr. p. 53.
1920. *Œdaleus senegalensis*, Sjöstedt (nec Krauss !), *l. c* p. 53.

The only species of *Œdaleus* occurring commonly in Australia can be easily separated from the true *O. senegalensis*, Kr., described from Senegal and confined in its distribution to the more southern parts of Palæarctic deserts, by the pronotum distinctly angulate behind and the hind wings strongly infumate apically in both sexes. As regards the Palæarctic *O. decorus*, Germ. (=*nigrofasciatus* auct., nec De Geer; see Novit. Zoolog. xxx. 1923, p. 69), this is a much larger insect, with the pronotum rectangular behind, and it cannot possibly be confused with *O. australis*.

The relative height of the pronotal carina in this genus is not very constant, which makes Sjöstedt's key for separating two supposed Australian species useless.

Goniæa vocans (F.).

1775. *Gryllus vocans*, Fabricius, Systema Entom. p. 290.
1920. *Goniæa acuta*, Sjöstedt, Acrid. Austr. p. 142 (*syn. nov.*).

It is not easy to comprehend why Kirby should have identified *G. vocans* with *alta* of Walker, while the types of the two species have been at his disposal and they are strikingly different. Indeed, *vocans* belongs to the group of species with a relatively low median pronotal carina very distinctly interrupted by the third sulcus, while *alta* is remarkable for the very high and entire carina. Sjöstedt, who knew that the type of *vocans* is in the Banks collection in London, somehow missed seeing it when working in the British Museum, and relied entirely on Kirby in the interpretation of *G. vocans*.

There are two type-specimens of *G. vocans* in the Banksian collection, both females; they are undoubtedly conspecific, and agree quite well with Sjöstedt's description and figures of *Goniæa acuta*, as well as with a female cotype of the latter species in the British Museum collection.

Goniæa alta (Walk.).

1870. *Tropinotus australasiæ*, var. *alta*, Walker, Cat. Derm. Salt. Brit. Mus. iii. p. 530.
1920. ||*Goniæa vocans* (nec Fabr. !), Sjöstedt, Acrid. Austr. p. 136 (*syn. nov.*).

As stated above, *alta* is quite different from *vocans*. Sjöstedt's diagnosis of *vocans* (nec F.) is, consequently, that of *alta*, which I consider a good species related to *macronotum*, Sj.

Genus PHAULACRIDIUM, Br. W.

1893. *Phaulacridium*, Brunner, Ann. Mus. Civ. Genova, xxxiii. p. 151.
1897. *Phaulacridium*, Hutton, Trans. N. Zeal. Inst. xxx. p. 140.
1910. *Phaulacridium*, Kirby, Syn. Cat. Orth. iii. p. 442.
1920. *Biformalia*, Sjöstedt, Arkiv Zool. xii. no. 20, p. 49.
1920. *Phaulacridium*, Sjöstedt, Acrid. Austr. p. 199.

Brunner described this genus without any named species in it, and Hutton was the first reviser who included in it two species—*Caloptenus marginalis* of Walker and *Ph. luteum*, Hutton. This caused Kirby to quote the first-named species as the type of the genus *Phaulacridium*, and no objection can be possibly raised to this statement. Sjöstedt, however, while synonymizing quite correctly his genus *Biformalia* with *Phaulacridium*, found it impossible to accept Kirby's fixation of genotype of the latter, and proposed to regard his *Biformalia vittata* as the type of *Phaulacridium*. This was, apparently, due to the fact that he examined in the British Museum not the actual types of *Caloptenus marginalis*, Walk., but other specimens incorporated under that name in the collection, most of them being members of the genus *Trigoniza*, while the types are true *Phaulacridium*. Fortunately, this oversight does not affect the status of the genus *Phaulacridium*, the type cited by Sjöstedt being obviously congeneric with the Walkerian species.

Phaulacridium nanum, Sj.

Sjöstedt described this species from a single female, and a series of specimens of both sexes before me now shows that the coloration is very variable; in the darkest-coloured specimens the hind tibiæ are not red, but testaceous. As regards morphological characters, the species seems to be somewhat aberrant from its congeners, differing in the narrow vertex not separated from the frontal ridge and in the low broad prosternal tublercle, but the whole group is not sufficiently well known to justify the erection of a new genus.

Genus MACROTONA, Br. W.

1893. *Macrotona*, Brunner v. Wattenwyl, Ann. Mus. Civ. Genova, xxxiii. p. 142.
1920. *Eumacrotona*, Sjöstedt, Arkiv f. Zool. xii. no. 20, p. 20 (*syn. nov.*).
1920. *Macrotona*, Sjöstedt, *l. c.* p. 20.

Brunner described this genus without any named species in it, and the first species has been made known by Brancsik in 1899, viz., *Macrotona lineola*, Brancs. Kirby, in his Catalogue (iii. p. 443), formally fixed Brancsik's species as the type of *Macrotona*. Sjöstedt, however, split up the genus into two, separating his own new species, *mjöbergi*, from the rest of the genus, and making that species the genotype of *Macrotona*, while *lineola* has been referred by him to his new genus *Eumacrotona*. Apart from these proceedings being against the established rules of genotype fixation, they are unnecessary, the only difference between the two genera being in the shape of the hind margin of pronotum, and that in one sex only. It is true that in *mjöbergi* pronotum is more definitely truncate behind than in other species, in which it is slightly rounded, but the degree of that roundness varies not only in different species, but also in the sexes of the same species, and this makes it impossible to base the generic separation on this single and purely relative character.

Macrotona australis (Walk.).

1870. *Heteracris australis*, Walker, Cat. Derm. Salt. Brit. Mus. iv. p. 670.
1920. *Eumacrotona picta*, Sjöstedt, Arkiv f. Zool. xii. no. 20, p. 55; Acrid. Austr. p. 230 (*syn. nov.*).

Walker described this species from four females (which he misidentified as males), all belonging to the same species, and I select here the specimen *b* of his Catalogue from Mr. Stutchbury's collection as the single type, this being better preserved than others.

A series of fresh specimens of both sexes before me now convinces me in the above synonymy which somehow escaped Sjöstedt.

The dimorphism in the coloration of the face of two sexes is very striking (see Sjöstedt's second description of the species).

Genus MACROCARA, nov.

Antennæ filiform. Head distinctly thicker and shorter than pronotum, raised above its level; face moderately reclinate; frontal ridge with the margins straight, gradually divergent, sulcate from above the ocellum downwards; fastigium of vertex sloping, forming a rounded angle with the frontal ridge, but separated from it, impressed above. Interocular space half again as broad as the frontal ridge at the ocellum. Eyes strongly prominent, scarcely oblique, broadly elliptical, equally broadly rounded above and below. Pronotum rounded, distinctly selliform; anterior margin somewhat ascending collar-like on to the occiput, rounded; transverse sulci distinct; metazona very distinctly shorter than prozona, punctured; median carina feeble; hind margin distinctly obtusangulate; lateral lobes much deeper than long. Prosternal tubercle low, obtusely conical, with a broad basis. Mesosternal lobes (♂) transverse; the interspace narrower than long and constricted in the middle; metasternal lobes separated. Elytra and wings fully developed. Hind femora broad, strongly tapering apically; upper carina not serrate, with a minute sharp apical spinule. Abdomen (♂) slightly incrassate apically; subgenital plate very short and obtuse; cerci strongly compressed, decurved.

Genotype: *Heteracris conglobata*, Walk.

Sjöstedt (Acrid. Austr. p. 229) included this species in his genus *Eumacrotona*, but it has very little in common with it, differing in the whole habitus, shape of the head and pronotum, structure of fastigium, and, particularly, in the shape of prosternal tubercle. This latter is a very low obtuse cone, and this separates the insect at once from *Eumacrotona* with its plate-like transverse tubercle.

In Sjöstedt's key to genera *Macrocara* comes near *Terpillaria*, differing from it in the structure of the head and pronotum.

Macrocara conglobata (Walk.).

1870. *Heteracris conglobata*, Walker, Cat. Derm. Salt. Brit. Mus. iv p. 671.
1920. *Eumacrotona conglobata*, Sjöstedt, Acrid. Austr. p. 229.

The male type is the only specimen known.

Macrocara picta (Sj.).

1920. *Terpillaria picta*, Sjöstedt, Acrid. Austr. p. 207.

This is clearly not a *Terpillaria*, but another member of my new genus, differing from the genotype in larger size, pattern of hind femora, and somewhat longer prosternal tubercle.

LXV.—*Three new Reptiles from Somaliland.*

By H. W. Parker, B.A.

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The collections of the British Museum of Natural History have recently been enriched by a large collection of reptiles and amphibians from British Somaliland, collected and presented to the Museum by Lieutenant R. H. R. Taylor, R.E. To this gentleman the author wishes to express his gratitude, not only for the generous gift, but for the care and patience he has shown in making what is probably the finest single collection of these animals from the region. It is hoped to publish a complete account of the whole collection at a later date, but preliminary descriptions may be given of some of the more easily recognised new species.

LACERTILIA.

Hemitheconyx taylori, sp. n.

Holotype a male, number 1930.5.9.1 from the Hegligab District (10° 22′ N. × 49° E.), 2500 feet.

Body stout; limbs short and weak; digits short. Snout bluntly rounded, as long as the distance between the eye and the posterior border of the ear; latter large, round, its diameter about half the length of the eye-opening. Head covered with regular polygonal scutes, each of which has a small central papilla; temporals not larger than the occipitals; rostral sub-quadrangular, twice as broad as high, its upper border emarginate, with a single granule in the emargination; nostril in a single ring-shaped nasal, which is in contact with the rostral and first upper labial, but separated from its fellow by five scales; seven or eight upper and seven lower labials; mental sub-pentagonal; no definite chin-shields, but the anterior scales somewhat larger than the median gulars. Body above with juxtaposed polygonal granules, which may, or may not, have a small central papilla, intermixed with numerous enlarged, obtusely keeled or papillate tubercles; these tubercles are largest dorso-laterally, where they are arranged in transverse triads, the central one largest. Lower surfaces with rather irregular, cycloid, imbricate scales. An uninterrupted ∧∧∧-shaped series of twenty-eight femoral and preanal pores. Tail swollen, constricted anteriorly and tapering posteriorly, with twelve annular constrictions above; caudal scales smooth above, with enlarged, almost flat, tubercles arranged in regular longitudinal and transverse series; inferiorly with larger flat scales.

Pinkish cream above, with traces of four broad transverse black bands, one across the neck, the second just in front of the hind limbs, the third across the narrow root of the tail, and the last just behind the middle of the tail; snout and sides of head smudged with darker. White beneath, the last caudal annulus alone continued across the ventral surface.

Total length 142 mm. Snout to vent 94. Snout to posterior border of ear 22. Width of head 22. Fore limb 33. Hind limb 39.

Paratypes. Nine males, females, and half-grown from the Oraogi District (10° 42′ N. × 49° 00′ E.), 2500 feet, Sorl Haud (10° 00′ N. × 49° 00′ E.), 3000 feet, and Bihen (8° 24′ N. × 48° 24′ E.), 1500 feet, numbers 1930.5.9.2–10 in the British Museum.

This series shows some slight variation. The rostral may be cleft above and not emarginate; the nasal ring may be semi-divided; the upper and lower labials vary from 7 to 8 and 6 to 8 respectively and the femoral pores from 23 to 28 in males, whilst they are completely absent in females. The reproduced tail is shorter, more globular, and bluntly rounded posteriorly, without marked annular constrictions, and lacks the enlarged tubercles of the normal form. The black transverse bands are very strongly marked in juveniles, but become less and less defined with age and may be almost completely absent in fully grown individuals; the black caudal annulus is not, or only incompletely, re-developed on the reproduced tail.

Largest male: 110 mm. from snout to vent.

Largest female: 105 mm. from snout to vent.

All the specimens were collected under stones; the animal is lethargic when disturbed during daylight and produces a sound resembling a cough.

References of this new species to *Hemitheconyx* * greatly extends the known range of the genus and also renders its distribution discontinuous, for *H. caudicinctus* (Dum.), the only other species, is confined to Africa west of Nigeria. There is little doubt, however, that the two are really congeneric, although very distinct specifically, and it is quite possible that these animals, probably nocturnal and to a greater or less extent deserticolous, will, in the future, be found to be much more widely distributed over northern Africa than they at present appear to be.

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* *Sensu stricto*, and not including *Holodactylus*, as suggested by Boulenger (Ann. & Mag. Nat. Hist. (6) xvi. 1895, p. 164).

OPHIDIA.

Typhlops leucocephalus, sp. n.

Holotype number 1930.5.9.11, in the British Museum, from Las Anod (8° 28′ N. × 47° 21′ E.), 2400 feet.

Snout very prominent, slightly hooked in profile, with an angular horizontal keel and lateral nostrils. Rostral large, nearly half as wide as the head, extending to the level of the anterior borders of the eyes, which are distinguishable; nasal incompletely divided, the suture proceeding from the second upper labial; præocular present, much narrower than either the nasal or the ocular, in contact with the second and third upper labials; four upper labials, the last very large; no subocular; nasals separated on the top of the head; upper head-scales slightly enlarged; twenty-four scales round the middle of the body. Diameter of body contained forty-three times in the total length; tail broader than long, terminating in a short spine.

Plumbeous above, the lateral borders of the scales black, producing a striped effect, which becomes more pronounced caudad. Head and lower surfaces uniform white; the line of demarcation between the upper and lower surfaces sharply defined, but forming a very irregular line.

Total length 212 mm.; tail 3 mm.

This species appears to be more closely allied to the Malagasy *T. bœttgeri*, Boulenger, than to any African form; it differs, however, in its more strongly hooked snout, broader head, smaller rostral, and colour. Its nearest African relatives appear to be *T. mossambicus* (Peters) and *T. punctatus* (Leach), from both of which it differs in its more strongly marked horizontal rostral keel, the origin of the nasal suture from the second, instead of the first, upper labial, and the more slender bodily form.

Prosymna somalica, sp. n.

Holotype a male, number 1930.5.9.12., from 8° N. × 47° 22′ E., 2000 feet.

Rostral very large and broad, with sharp horizontal edge; a pair of small internasals, in contact mesially; præfrontal single; frontal large, more than half the width of the head, about as long as the parietals and longer than its distance from the end of the snout; loreal subquadrangular, deeper anteriorly than posteriorly, and longer than deep; one præ- and one postocular, both touching the supraocular; temporals 1+2; six upper labials, the third and fourth entering the eye; two pairs of chin-shields, the posterior longer than the anterior, and widely separated by a single scale. Scales smooth, with apical pits, in fifteen rows; ventrals 121; anal entire; subcaudals 38+1. Dark purplish brown above, each scale with a narrow light line parallel with, and close to, its free edge; uniform whitish beneath.

Total length 193 mm.; tail 39 mm.

The combination of paired internasals, single præfrontal, single anterior temporal, and single postocular serves to distinguish this species at once from any of its congeners; it is probably most closely allied to *P. meleagris* (Reinhardt) and *P. greigerti*, Mocquard. The lepidosis is, with the exception of the paired internasals, very similar to that of *Asthenophis ruspolii*, Boulenger, but the dentition is that of a typical *Prosymna*.

LXVI.—*Some Parasitic Nematodes from Japanese Amphibia.*

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The parasites described in this paper were contained in a collection of Nematodes from Japanese amphibia made by Professor A. S. Pearse, of Duke University, Durham, N.C., U.S.A., during a visit to Keiogijuku University, Tokyo, and presented by him to the British Museum (Natural History). They were handed to the writer by Dr. H. A. Baylis for study and determination. The collection included worms from the following hosts * and localities:—

Urodela.

Triturus [*Diemyctylus*] *pyrrhogaster* (Boie).—Kikijoji; Tanichi; Sakujii.

Onychodactylus japonicus (Houtt.).—Hatta, near Hakone; Yumoto.

Tylototriton andersoni, Blgr.—Riu Chu.

Hynobius [*Pseudosalamandra*] *stejnegeri*, Dunn.—Yawata-Machi, near Mt. Moji, Kyushu; Kagoshima.

Hynobius [*Pseudosalamandra*] ? *kimuræ*, Dunn.—Chiri, Shimoina County, Nagano Prefecture.

Hynobius fuscus, Tago.—Udaeki Falls, Yumoto.

Hynobius sp.—Tanichi.

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* Mr. H. W. Parker, of the British Museum (Natural History), has kindly revised the names of the hosts.

ANURA.

"Bull-frog" [? *Rana japonica*, Günther].—Tokyo.

Upon examination the worms were found to belong to the families Trichinellidæ, Oxyuridæ, and Heterakidæ, together with specimens of *Rhabdias* ; some larval forms which could not be determined; and, lastly, a few specimens of *Rhabditis* from *Onychodactylus japonicus*, which were considered as accidental parasites.

Family Trichinellidæ.

Capillaria filiformis (v. Linst., 1885).

Members of the family Trichinellidæ occurred in three hosts, all Urodeles: *Triturus pyrrhogaster, Hynobius stejnegeri, H.* sp. They so closely resembled *C. filiformis* in appearance and in measurements (except for certain slight variations in the length of the œsophagus) that it is not thought possible to regard them as distinct from this species, although *C. filiformis* has previously been recorded only from two European hosts: *Triturus alpestris* and *T. cristatus.*

Family Oxyuridæ.

From *Triturus pyrrhogaster* some female Oxyurids were obtained, but, as there were no males, it was impossible to determine their species, or even to be certain of their genus. They very closely resembled females of *Aplectana.* The specimens from *Onychodactylus japonicus*, *Hynobius stejnegeri*, and *H.* ? *kimuræ* also included a few female Oxyurids which appeared to belong to the genus *Pharyngodon.* Rhabditids were also found in *O. japonicus* and *H. fuscus.*

In the "Bull-frog" and in *Tylototriton andersoni* some Oxyurids were found which closely resemble *Cosmocerca,* but it has been thought desirable to place them in a new genus. Of this genus one specimen only, a male, was found in *Tylototriton,* but many specimens, including eight or nine males, were found in the "Bull-frog."

COSMOCERCOIDES, gen. nov.

These worms have two equal spicules and a well-developed gubernaculum. They therefore belong to Railliet's subfamily Cosmocercinæ (1916). They have three small lips, an œsophagus with a short "pharynx," and an œsophageal bulb with three chitinoid valves. The tail in both sexes is long and tapering. The vulva of the female is behind the middle of the body. There are no lateral alæ. The ventral surface of the male bears structures which at first sight appear to be "plectanes" similar to those of *Cosmocerca,* but which on closer examination prove to be large papillæ having a surrounding ring of tubercles, purely cuticular in structure, and unsupported by any internal skeleton. Although these are possibly homologous with the "plectanes" of *Cosmocerca,* and both may be modified papillæ, it seems desirable to restrict the term "plectanes" to organs of the type found in *Cosmocerca,* i.e., possessing an internal supporting structure. Steiner (1924) has described and figured another form of "plectane" in *Cosmocercella.* He does not appear to think a difference in this structure of generic value, since he says "*Cosmocerca* . . . . differs from the present genus (*Cosmocercella*) in the absence of a vesiculate bursa." But the most definite character of the genus *Cosmocerca* is the possession of bent chitinoid rods beneath the cuticle and forming part of the "plectanes." This structure is clearly seen in specimens of *C. ornata* in the British Museum collection, and is one which could not easily be overlooked. Moreover, an excellent figure of this form of "plectane" is given by Dujardin, and the same chitinoid rod is seen in the published figures of all the species of the genus with the exception of *C. dukæ,* Holl, 1928. The figure of this species shows no supporting rod, and the text states that the vulva is behind the middle of the body. Large papillæ are shown having a distinct palp and surrounded by cuticular tubercles. It seems probable therefore that *C. dukæ* should not have been placed in the genus *Cosmocerca,* but is a species of the new genus *Cosmocercoides.*

Diagnosis of the Genus Cosmocercoides.—Cosmocercinæ. Males furnished with complex caudal papillæ (large papillæ, each of which is surrounded by a ring of cuticular tubercles). No lateral alæ. No vesiculate bursa. The vulva of the female behind the middle of the body.

Type: *C. pulcher,* sp. n.

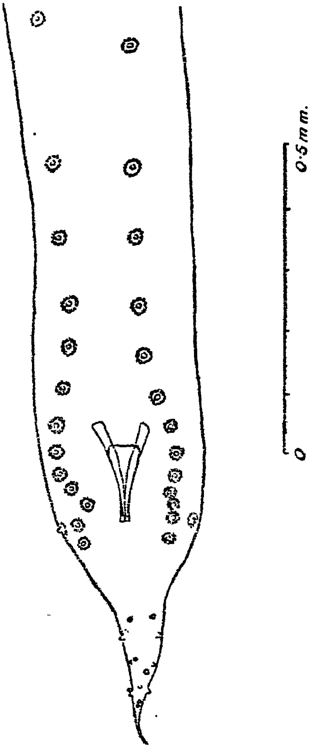
Cosmocercoides pulcher, gen. et sp. n. (Figs. 1 & 2.)

Over a hundred worms were found by Prof. Pearse in the rectum of a "Bull-frog" (? *Rana japonica*) at Tokyo. Of these about ten males and sixty females belonged to the genus *Cosmocercoides,* the other worms being Heterakids (*q.v. inf.*).

The males are 6·9 mm. long and 0·43 mm. in thickness (maximum). The diameter of the head is 0·05 mm.; the length of the tail 0·22 mm. The œsophagus is 1·2 mm. in length, of which 0 16 mm. is occupied by the bulb and

0·09 mm. by the pharynx. The bulb is 0·18 mm. wide. There are two well-chitinised but slender spicules 0·247 mm. long and 0·016 mm. in maximum thickness. A strong accessory piece shaped like a short spicule is present. It is 0·143 mm. long.

Fig. 1.

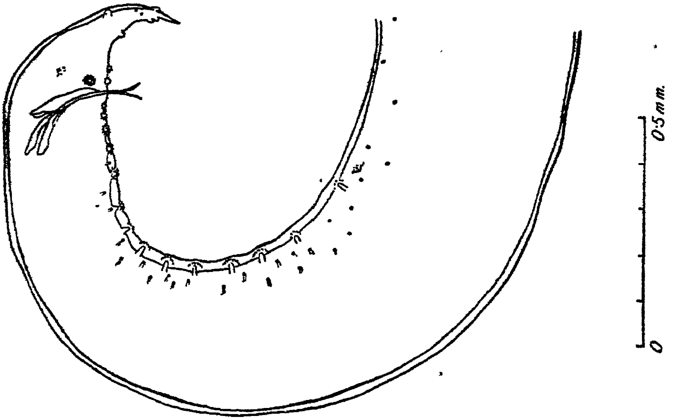


Cosmocercoides pulcher. Posterior end of male; ventral view.

The posterior third of the male bears on its ventral surface a double row of the complex papillæ characteristic of the genus. About 17 pairs are present in this double row (the number is variable, as the most anterior pair is not always present). Near the anus there is in addition a laterally placed pair outside the double row already mentioned. It will be seen that the most posterior pair is postanal. The postanal papillæ are: (1) A small ventral pair. (2) A large ventral pair (complex, at least in some specimens). (3) A large dorsal pair at the same level as (2). (4) Two small lateral pairs. (5) Two large lateral pairs. (6) A small ventral pair having the form of a double papilla. In front of the anus, in addition to the complex papillæ, there are a great many minute papillæ well seen only in lateral view (fig. 2).

In the female the vulva is behind the middle of the body. The length of the worm is 9·0 mm., and the vulva is 5·0 mm. from the anterior extremity. A thick-walled muscular vagina runs forward from the vulva for about 0·6 mm., then turns back and gives off two opposed uterine branches when it has again reached the level of the vulva. It is thus about 1·2 mm. long. The maximum thickness of the body is 0·54 mm., the diameter of the head 0·06 mm., and the length of the tail 0·38 mm. The total length of the œsophagus is 1·4 mm., of which length 0·18 mm. is occupied by the bulb and 0·10 mm. by the pharynx. The bulb is 0·22 mm. wide, and the excretory pore is 1·0 mm. from the anterior end of the body. The eggs measure 0·082 mm. by 0·049 mm.

Fig. 2.



Cosmocercoides pulcher. Posterior end of male; lateral view.

Cosmocercoides tridens, sp. n. (Fig. 3.)

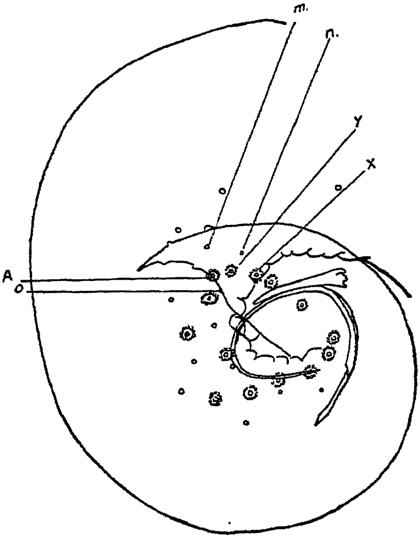
Host: *Tylototriton andersoni* (rectum).

Unfortunately only one specimen of this species was collected, and, although a male and well-preserved, it is so much coiled that it cannot be fully described without mutilation. However, the arrangement of the complex papillæ is well seen, and the usual measurements can be taken, so that it seems justifiable to make the specimen the type of a new species.

The length of the worm is 4·35 mm. and its maximum thickness 0·44 mm. The diameter of the head is 0·061 mm., and the three lips are very distinct. The length of the tail is 0·2 mm. The œsophagus is 0·93 mm. long. Of this length 0·082 mm. is occupied by the pharynx and 0·12 mm. by the bulb, which is 0·12 mm. wide.

The spicules are long and thin: 0·53 mm. long and 0·012 mm. wide. The accessory piece is 0·14 mm. long, and is characterised by the triple division of its broad end. The middle process of the three thus formed is slightly indented at its apex. The excretory pore is 0·52 mm. from the anterior end.

Fig. 3.



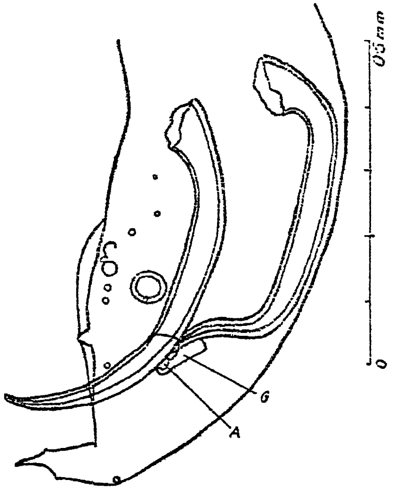
Cosmocercoides tridens. Posterior end of male; lateral view. For explanation of lettering, see text.

Of the complex papillæ, three pairs are postanal. These and the last five preanal pairs form a double row on the ventral surface, but the five pairs anterior to these are arranged in four rows, and appear to alternate with large simple papillæ, as shown in the figure (fig. 3). The most anterior pair of complex papillæ is in line with that immediately behind it. In fig. 3 the papillæ of the right side only are shown. The tail is curled under the body, so that the complex papillæ *X* and *Y*, and the simple papillæ *m*, *n*, and *o* on the tail, are seen through the body by transparency, while the complex papilla *A* on the body is at a higher focus.

Family **Heterakidæ**.

Among the specimens from the "Bull-frog" were also found about eight males and thirty females of a new species of Heterakid. These worms, although specifically distinct, very closely resemble *Spinicauda longispiculata*, Baylis, 1929, from *Gekko gecko* in Java. This is distinguished from other species of *Spinicauda* by the length of the spicules. Baylis says, "The spicules measure 0·625–0·68 mm. . . . . The nearest approaches to it are made by *S. campanula* (v. Linstow, 1899) with spicules 0·46 mm. long, and *S. spinicauda* (Olfers, 1819) with spicules 0·43–0·45 mm. long." More recently (1930) Baylis has described another species, *S. australiensis*, from *Tiliqua scincoides* in Queensland, having spicules 0·6–0·65 mm. long. The Japanese worm has spicules 0·67 mm. long. It appears, in fact, that the Oriental species of *Spinicauda* are distinguished by their longer spicules from the Western forms.

Fig. 4.



Spinicauda japonica. Posterior end of male; latero-ventral view. A, anus; G, gubernaculum.

Spinicauda japonica, sp. n. (Fig. 4.)

Host: "Bull-frog."

The male is 5·9 mm. long and 0·38 mm. in maximum width. The diameter of the head is 0·04 mm. The tail, terminating in a small spine 0·05 mm. long, is about 0·3 mm. in total length. The œsophagus, measured from the anterio extremity of the worm, is 1·18 mm. long. This length includes a bulb 0·22 mm. long and 0·17 mm. wide, and a pharynx 0·08 mm. long. The excretory pore is 0·6 mm. from the anterior end. The spicules are long and stout, and have a markedly granular appearance. They are 0·67 mm. long, and have a maximum width of 0·05 mm. for the blade, widening to 0·09 mm. at the base. An accessory piece is present, though but slightly chitinized. It is 0·08 mm. long. There is a pre-anal sucker 0·06 mm. in diameter. The papillæ are fewer than in the nearly related *S.' longispiculata*. There are eight pairs preanal, two adanal, and at least three postanal. Of these three preanal pairs are large and fleshy, one of the adanal pairs is very large, while the other pairs are small, especially the most anterior pair. Two postanal pairs are sub-dorsal, and one is ventral. The figure (fig. 4) shows the papillæ of the right side only.

The length of the female is 6·15 mm., and its width 0·36 mm. The diameter of the head is 0·45 mm. The œsophagus is 1·10 mm. long. The tail is conical and 0·5 mm. long, terminating in a minute spike 0·04 mm. long. The excretory pore is 0·6 mm. from the anterior end of the worm. There is a short pharynx 0·08 mm. in length. The bulb of the œsophagus is 0·23 mm. long and 0·21 mm. wide. The vulva is in the anterior half of the body, 2·4 mm. from the anterior end, thus dividing the body in the ratio of 6 : 9. The eggs measure 0·086 mm. by 0·049 mm.

Family **Rhabditidæ.**

Rhabdias tokyoensis, sp. n.

A number of specimens of *Rhabdias* were found by Prof. Pearse in the lungs of *Triturus pyrrhogaster*. These appear to belong to a new species. A table is given showing the measurements of this species and of another new species (*vide infra*) contrasted with those of other Asiatic forms.

Rhabdias incerta, sp. n.

Another species of *Rhabdias* was found in the lungs of the "Bull-frog." Measurements of this form are also given in the table. It resembles in some points *R. brachylaimus* (v. Linst., 1903), but this is a very incompletely described species, and it seems desirable provisionally to regard the Japanese form as distinct.

In both these Japanese species of *Rhabdias* minute teeth appeared to be present at the base of the buccal capsule, but in neither was the material well enough preserved to make it quite certain that teeth were present.

Asiatic Species of Rhabdias.
(*Measurements in millimetres.*)

	brachylaimus (v. Linst., 1903).	*escheri*, Baer, 1930.	*tokyoensis*, sp. n.	*incerta*, sp. n.
Length	8·8	5 to 6	12	14·3
Thickness	0·48	0·25–0·26	0·52	0·4
Buccal capsule:				
length	..	0·0145	0·028	0·029
width.............	..	0·0145	0·025	0·037
Teeth in buccal capsule..	No teeth. 3 small lips.	..	?	?
Œsophagus, length	$\frac{1}{13}$ of body.	$\frac{1}{11}$	$\frac{1}{18}$	$\frac{1}{11}$
Position of vulva	Middle of body.	8:6	8:7	Middle.
Form of tail	Pointed.	Conical.	Conical.	Tapering.
Length of tail	..	0·12	0·28	0·4
Eggs: length	0·12	..	0·11	0·094
„ width..........	0·065	..	0·05	0·049
Host	*Bufo.*	*Uræotyphlus oxyurus* (Gymnoph.).	*Triturus pyrrhogaster* (Urodela).	"Bull Frog."
Habitat	Lung (?).	Body-cavity.	Lung.	Lung.
Locality.............	Siam.	India.	Japan.	Japan.

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LXVII.—*A Description of the Type-specimen of* Ichthyosaurus crassimanus, *Blake (Owen MS.)*. By SIDNEY MELMORE, B.Sc., F.G.S.

[Plate XVI.]

THIS specimen was presented to the Yorkshire Philosophical Society by the Rev. D. R. Roundell in the year 1857. It was at the time considered to be *I. platyodon*, Cb.[*]. The specimen was discovered while the Alum Shale Quarries north of Whitby were being worked—that is to say, it occurred in the zone of *A. communis*, which is correlated with the "Schichten der *Posidonomya bronni*" (in part)[†], the horizon in which the type-specimen of *I. trigonodon*, Th., was found.

In 1858 Owen examined the specimen and assigned to it the name *I. crassimanus*, representing, but specifically distinct from, *I. platyodon* of the Lias of Dorset[‡]. The species was never described by Owen, but a brief account of this specimen was included by R. Tate and J. F. Blake in their treatise on 'The Yorkshire Lias' (1876, p. 253).

R. Lydekker[§] expressed the opinion that "there is at present no reason for separating *I. crassimanus* of the Whitby Lias" from *I. trigonodon*, Th.

In their 'Catalogue of British Fossil Vertebrata' (1890, p. 240), A. S. Woodward and C. D. Sherborn enter the species with a query under *I. trigonodon*. In this they are followed by E. Fraas[||] and C. Fox-Strangways[¶]. Finally, in the 'Geology of the Country between Whitby and Scarborough,' by C. Fox-Strangways and G. Barrow (ed. 2, 1915, p. 20), the two species are definitely equated.

Description of the Specimen.—The great size of the specimen excludes from comparison all other species except *I. trigonodon*, Theodori, and *I. platyodon*, Conybeare. For an account of these, reference has been made to C. Theodori's 'Beschreibung des kolossalen *Ichthyosaurus trigonodon*,' München, 1854, and R. Owen's 'Monograph of the Fossil Reptilia of the Liassic Formations,' part iii. (Palæontographical Society, 1865–1881).

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[*] Ann. Rept. Yorks. Phil. Soc. for 1857 (1858), p. 7.

[†] C. Fox-Strangways, Jurass. Rocks Brit. vol. i. (1892), p. 131.

[‡] Ann. Rept. Yorks. Phil. Soc. for 1858 (1859), p. 9.

[§] R. Lydekker, Cat. Foss. Rept. B.M. pt. ii. (1889), p. 105.

[||] E. Fraas, 'Die Icththyosaurier der süddeutschen Trias- u. Jura-Ablagerungen,' Tübingen, 1891, p. 77.

[¶] C. Fox-Strangways, *op. cit.* vol. ii. (1892), p. 121.

In this description all dimensions are expressed in metres.

The specimen is in two parts, the caudal and trunk regions measuring 5·7 in length being embedded in one slab of the matrix so as to exhibit the dorsal aspect and the skull in another. The limbs of the left side are not so perfect as those of the right. The latter are alone considered here.

The skull is poorly preserved, and it remains to note only its general proportions and the size of the vacuities. The occipital condyle, however, is clearly exposed, and measures 0·122 in width and 0·103 in height, corresponding in shape to the vertebræ, which are also wider than high. The length from the occipital condyle to the end of the snout measures 1·96; and from the anterior border of the orbits to the end of the snout 1·3.

The orbit measures 0·33 in length and 0·165 in width. The length and width of the narial openings are 0·152 and 0·076. Their anterior border is 0·897 distant from the occipital condyle. The supratemporal vacuities measure 0·38 long and 0·15 wide.

The greatest width at the back of the skull is 0·78, and that across the squamosals 0·458. It is of roughly constant width up to the posterior border of the orbits, where it begins to taper rapidly until across the anterior border it measures 0·502. There is a slight expansion in the region of the nares; across their anterior border the width is 0·382. At a point 1·036 forward from the occipital condyle the width is 0·203, and from this point the snout tapers very gradually at a constant angle.

Only one tooth preserves its cement. It measures 0·025 in length above the ramus and 0·018 in diameter at the base. It is thus more slender than the teeth of *I. trigonodon.* It is oval in cross-section, and does not possess the trigonal shape characteristic of Theodori's species.

The Vertebræ.—Owing to their well-marked difference in diameter the vertebræ can be divided into a precaudal series of forty-seven (the fifteenth and sixteenth are, however, missing) and a caudal series of thirty-nine. A few more vertebræ are necessary to complete the tail.

The anterior vertebræ are 0·051 to 0·056 in length. The eighteenth to the twenty-fifth are 0·067 long, the thirty-eighth 0·071. The neural spines are not preserved in the precaudal series. In the case of the twentieth vertebra the distance across the tops of the neurapophyses is 0·07 and the width of the bottom of the neural canal 0·032. So far as can be seen, the centra carry only a single prominent costal tubercle with an elliptical concavity at the end. In the seventeenth precaudal the apex of the tubercle is 0·084 distant from the centre of the neural canal. There is a protuberance above the matrix which may represent a second tubercle distant 0·045 below the upper one on the twenty-third vertebra. In *I. trigonodon* there is no concavity, or at most only a scarcely noticeable depression at the end of the tubercle. Moreover, in that species (Theodori, pl. iii. figs. 20, 21) some vertebræ carry only one tubercle diametrically opposite its fellow and others have two, the uppermost of which occupies the same position as the single tubercle in *I. crassimanus*. The seventeenth vertebra is 0·135 in width. The height cannot be measured, owing to the matrix, but it is clearly less than the width, as in *I. trigonodon*.

The pelvic girdle begins at the forty-third vertebra and ends at the forty-seventh. In many of the caudals the neural spine is preserved; that on the fourth is 0·065 high. The first caudal is the largest of all the vertebræ, being 0·197 in width and 0·073 in length. The centrum of the last remaining caudal is 0·069 in width and 0·064 in height. The distance from the middle of the neural canal to the apex of the costal tubercle is 0·045, and the over-all measurement across the neurapophyses is 0·041. One of the largest vertebræ in *I. trigonodon* is only 0·066 in length.

The Ribs.—The ribs increase in length to about the eighteenth vertebra, and begin to shorten at about the twenty-seventh. That attached to the sixteenth is 0·025 in diameter near its proximal end; and for the rib between the thirty-seventh and thirty-eighth the corresponding measurement is 0·016. There are indications of caudal ribs.

The Scapula and Clavicle.—The bones of the shoulder-girdle have suffered some displacement. The coracoid is not visible; the bone so described by Tate and Blake is clearly the scapula. It is an elongated bone, as much of it as is visible measuring 0·203 in length. Its width where it disappears under the ribs is 0·132. The upturned distal end is 0·083 wide and 0·029 thick. Theodori gives 0·12 for the narrower end of his scapula, and Owen's drawing * of that bone in *I. platyodon* measures 0·091. Under the anterior border of the scapula is a fragment of bone 0·028 in diameter at its thinnest part, and 0·032 at the distal end. It is evidently part of a clavicle. Owen's drawing of the clavicle of *I. platyodon* measures 0·036 across the middle part.

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* R. Owen, *op. cit.* pl. xxxi. fig. 3.

The Humerus (Pl. XVI. fig. 2).—This bone measures 0·292 in length; it is 0·168 in diameter across the proximal end, 0·260 distally, and 0·132 in diameter at the middle of the shaft. In *I. trigonodon* the corresponding values are 0·28, 0·18, 0·25, and 0·156. The outline of the bone, although it is less expanded proximally, resembles that of *I. platyodon* (*cf.* Owen, pl. xxxi. fig. 1). It is quite unlike the stout humerus of *I. trigonodon* (Theodori, pl. iii. fig. 4). Owen does not give any measurements of his bone, but Lydekker* has some relating to a humerus provisionally referred to *I. platyodon.* Thus, length of humerus equals 0·235; transverse diameter of distal extremity 0·191. Taking the ratio diameter of distal end : length, we get 0·813. In *I. trigonodon* the corresponding ratio is 0·893 and in *I. crassimanus* 0·890. The great difference between the bones in the two latter species is well brought out if, in the above ratio, we substitute the diameter through the middle of the shaft in place of that through the distal extremity. This fraction is 0·557 in *I. trigonodon* and 0·452 in *I. crassimanus.*

The Radius and Ulna.—In *I. platyodon* the anterior border of the radius is notched; so also is the radio-carpal and succeeding bone. In *I. trigonodon* also the radius is notched anteriorly, and a large number of posterior plates of the front paddle are also notched posteriorly.

In *I. crassimanus* none of the bones are notched, but the radius has a conical depression near the anterior margin (Pl. XVI. fig. 2). The only other bone possessing this feature is that beyond the radiale. The radius is 0·095 long and 0·130 wide; the ulna 0·092 long and 0·130 wide. The ulnare, intermedium, and radiale have the following dimensions:—

	Ulnare.	Intermedium.	Radiale.
Length	0·075	0·070	0·070
Width	0·085	0·120	0·100

In *I. crassimanus* the ratio length of radius : length of humerus is 0·325 and in *I. trigonodon* 0·446.

The inferior end of the paddle has been badly reconstructed from scattered bones, but the corresponding member on the left side is complete and measures 1·03 in length from the distal end of the humerus. The greatest width across the four digits is 0·36. The more rounded phalanges have a prominent marginal ring.

The Pubis.—A fragment of this bone remains near its natural position. It can be seen, greatly foreshortened, in

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* R. Lydekker, *op. cit.* p. 104.

Pl. XVI. fig. 1, lying on the head of the femur. It measures 0·084 in length, 0·064 across the distal extremity, and 0·041 at the broken end.

The Femur (Pl. XVI. fig. 1).—This bell-shaped bone is 0·228 in length. The diameter of the proximal end is 0·130. The margin of the distal end is very slightly trilobed and measures 0·197 across. As much as remains of the left femur, however, indicates only a double curvature for the articulation of tibia and fibula. The length of the femur is 0·781 times the length of the humerus. The diameter through the narrowest part of the shaft is 0·097. In *I. trigonodon* the proximal end of the femur is 0·145 wide, in the middle of the shaft 0·12, and at the distal end 0·195. The length is 0·893 times the length of the humerus, the absolute length being 0·25.

The Tibia and Fibula.—The tibia is 0·073 long and 0·098 wide. The corresponding dimensions of the fibula are 0·073 and 0·083. The ratio of the length of the tibia to the length of the femur is 0·320. The fibula, fibulare, and succeeding bones have a conical depression near their posterior margin. The length of the hind paddle is 0·463, measured from the distal end of the femur to the extremity. The greatest width is 0·228. The length of the hind paddle to that of the fore paddle is 0·597. In *I. platyodon* the two limbs are of nearly equal size. In the type-specimen of *I. trigonodon* the pelvic paddles are missing.

Conclusion.—Although the relative length of the snout and the size of the skull and its vacuities are similar in *I. crassimanus* and *I. trigonodon*, the following points, apart from minor details peculiar to the former, are sufficient to show that the two must still be regarded as distinct species:—

The crown of the tooth is conical, not trigonal.

The vertebræ are longer and their costal tubercles have a distinct concavity in the vertex.

The humerus and femur are thinner in proportion to their length.

The femur is proportionately shorter in relation to the humerus; and the radius is proportionately shorter, relatively to the humerus, than is the case in *I. trigonodon.*

EXPLANATION OF PLATE XVI.

Ichthyosaurus crassimanus, Blake (Owen MS.).

Fig. 1. Dorsal aspect of pelvic limb.
Fig. 2. Right pectoral limb.

LXVIII.—*Sawflies collected by the Oxford University Expedition to British Guiana*, 1929. By ROBERT B. BENSON, M.A.

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A FULL account of the Oxford University Expedition to British Guiana, 1929, has already been given by the leader, Major R. W. G. Hingston, in the 'Geographical Journal,' lxxvi., July 1930, pp. 1–24. The other entomologists on the expedition were Mr. O. W. Richards and Mr. J. E. Duffield. Among the insects brought back and handed over to the British Museum, there are only eight specimens of sawflies, and they are as follows:—

SIRICOIDEA.

Derecyrta jakowlewi, Tschitscherine.

Derecyrta jakowlewi, Tschitscherine, Hor. Soc. Ent. Ross. xxviii. p. 436 (1894).

1 ♀, Essequibo River, Moraballi Creek, 6. ix. 1929; "in the forest."

1 ♀, Essequibo River, Moraballi Creek, 21. ix. 1929; "sitting on the wooden rail of a bridge."

These presumably belong to this species, as they agree with the description in practically all points of colour, structure, and size. The antennæ, however, are 26-segmented and 25-segmented respectively, while in the type they are said to be 22-segmented; and the second recurrent nervure in the fore wing is received some distance from the second intercubitus in the third cubital cell, while in the type these two nervures are said to be interstitial.

There would be nothing unusual in these variations occurring within one sawfly species. *Derecyrta pictipennis*, Kirby, was described as having 23-segmented antennæ; the antennæ in the type-specimen are now missing, but another specimen so named from Kirby's own collection, and also now in the British Museum, has 25-segmented antennæ.

TENTHREDINOIDEA.

Argidæ.

Topotrita leucocephala, Klug.

Hylotoma leucocephala, Klug, Jahrb. Ins. i. p. 248 (1834).

1 ♀, Essequibo River, Moraballi Creek, 28. x. 1929; "in the camp clearing."

Ptilia leucosoma, Cameron.

Rusobria leucosoma, Cameron, Trans. Ent. Soc. London, 1878, p. 151 (1878).

1 ♀, Essequibo River, Monkey Jump, 8. x. 1929; "on the river bank."

Miss Maud D. Haviland (Mrs. H. H. Brindley) also bred two females of this species at Kartaba in July 1922. The food-plant was not ascertained, but Mrs. Brindley tells me she thinks it was some low-growing herbaceous plant in rather dense secondary growth or shade forest—not in open places. The cocoons, preserved with the specimens, which are in the British Museum, are transparent, of very loose texture, and golden in colour, and they are attached longitudinally to the leaf-stalks of the food-plant.

Tenthredinidæ.

SELANDRIINÆ.

Stromboceros ictericus, Klug *.

Tenthredo icterica, Klug, Mag. Ges. Naturf. Berlin, viii. p. 79 (1814).

2 ♀♀, Essequibo River, Moraballi Creek, 10. ix. 1929; "low bush."

Stromboceros sagmarius, Kon. *.

Stromboceros sagmarius, Konow, Wien. Ent. Zeit. xviii. p. 298 (1899).

1 ♀, Essequibo River, Moraballi Creek, 23. ix. 1929; "in a swamp among plants of *Monotagma parkeri* (Roscoe) K. Schum." †.

Loboceridæ.

Loboceras hippolyte, Kirby.

Loboceras hippolyte, W. F. Kirby, List Hym. Brit. Mus. i. p. 80 (1882).

1 ♀, Essequibo River, Moraballi Creek, 9. ix. 1929; "trail."

This specimen differs in several minor details from Kirby's type, which is in the British Museum.

The antennal segments 1 and 2 of the type are all yellow, 3 and 4 are mostly pale with dark hairs; in this specimen 1 and 2 are all yellow, while 3 onwards are all black. The wings of the type are less yellow at the base and more fuscous at the apex; the apical half of the radial cell in the fore wing is dark: in this specimen the wings are more yellow at the base and less fuscous at the apex; only the apical quarter of the radial cell in the fore wing is dark. The hind tibiæ of the type are black on the apical half, and in this specimen they are black on the apical three-quarters.

In the antennæ of the type segment 7 is greater than 6, while in this specimen 6 is greater than 7. In the type the second recurrent nervure of the fore wing is interstitial with the second intercubitus, and the second cubital cell is one and a half times as long as the third cubital; in this specimen the second recurrent nervure is received well into the third cubital cell, and the second cubital cell is about as long as the third cubital.

---

* I am indebted to Dr. Runar Forsius of Finland for comparing these with specimens in his own collection and giving me these names.

† The name of this plant was supplied by Mr. Sandwith from Kew. Mr. Sandwith was one of the botanists on the expedition.

LXIX.—*A short Description of Two new Species of* Dendromus *from S.W. Africa.* By J. St. Leger.

Amongst the rodents included in the large collection of mammals recently sent by Captain Shortridge to the British Museum are two tree-mice of the *Dendromus mesomelas* and *Poemys nigrifrons* groups, which prove to be new, and for which I propose the names *Dendromus m. major* and *Dendromus* (*Poemys*) *n. shortridgei* respectively. It is hoped that a full account of the whole of this large collection will be published later.

Dendromus mesomelas major, subsp. n.

♂, 6931 (type), Ssanukanu Village, Grootfontein Dist.
♀, 7778, Diwai (near Bagane Drift), W. Caprivi.

A large *Dendromus* of the *mesomelas* group, but with skin and skull measurements equal to those of the E. African *D. insignis*, and dorsal stripe as broad as in that species.

Colour rather bright buffy brown, slightly darker than in *mesomelas*. Dorsal stripe commencing behind shoulders, 4–6 mm. in width. Ventral surface white slightly washed buffy, the hairs grey basally, but the grey not affecting the general white appearance, and very different from the greyish ventral surface of *D. insignis*. Hairs of throat and chest white to the roots.

Type.—Adult male (B.M. no. 30.10.1.1), Ssanukanu Village, Grootfontein District, S.W. Africa.

Measurements of Type.—Head and body 90 mm.; tail 98 mm.; hind foot 24 mm.; ear 14 mm.; greatest length of skull 25 mm.

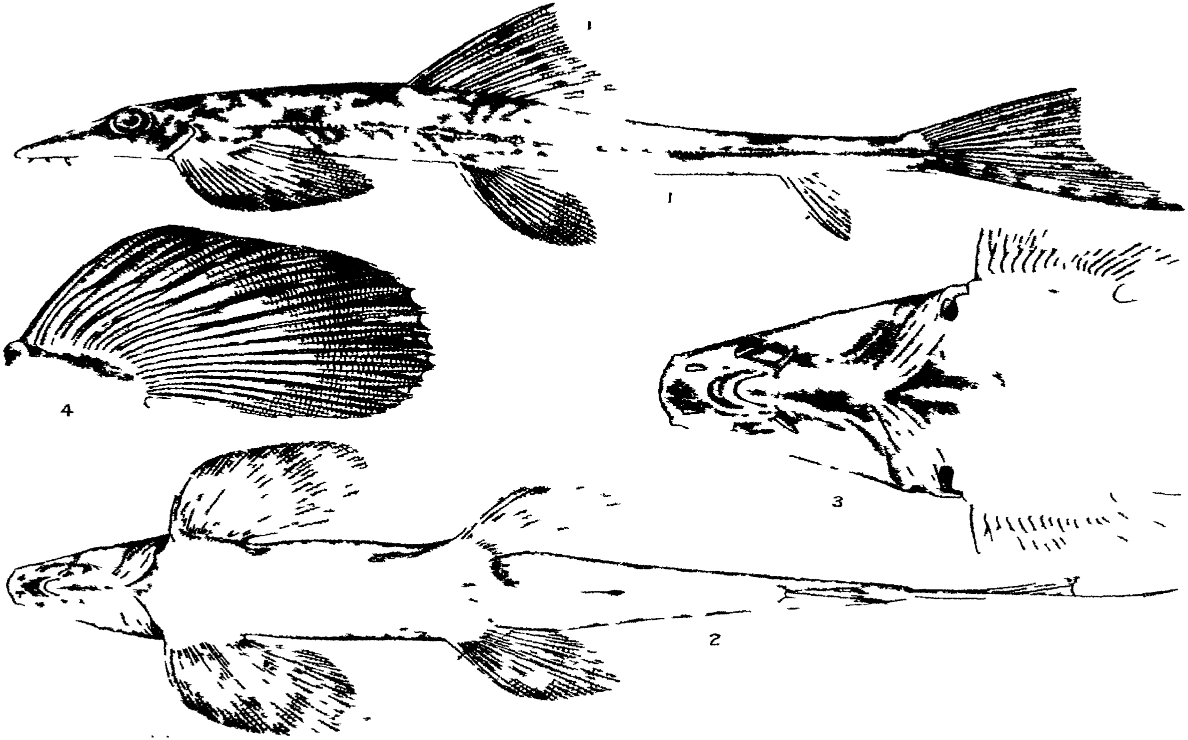
Dendromus (*Poemys*) *nigrifrons shortridgei*, subsp. n.

♂, 6773, 6834, 6835, 6836, 6839, 6870, 6917 (type), 6925.
♀, 6837, 6857, 6868, 6881, 6884, 6926, Ssanukanu Village, Grootfontein District.
♂, 6936, 7204, 7233, 7235, 7238.
♀, 7205, 7219, 7239, Okavango–Omatako Junction, Grootfontein District.
♂, 7975, Popa Falls, W. Caprivi.

A small *Dendromus* belonging to the *nigrifrons* group. Size and general appearance much as in true *nigrifrons* from British East Africa, but under surface heavily washed white instead of greyish or brownish, and completely lacking the buffy colouring of its nearest geographical ally *D. nigrifrons vulturus*, from Rhodesia. Dorsal surface rather greyer than in either the East African or the Rhodesian races. Head-spot and dorsal line well marked, the latter rather broader than usual.

Type.—Adult male (B.M. no. 30.10.1.2), Ssanukanu Village, Grootfontein District, South-West Africa.

Measurements of Type.—Head and body 69 mm.; tail 77 mm.; hind foot 19 mm.; ear 16·5 mm.; greatest length of skull 20·9 mm.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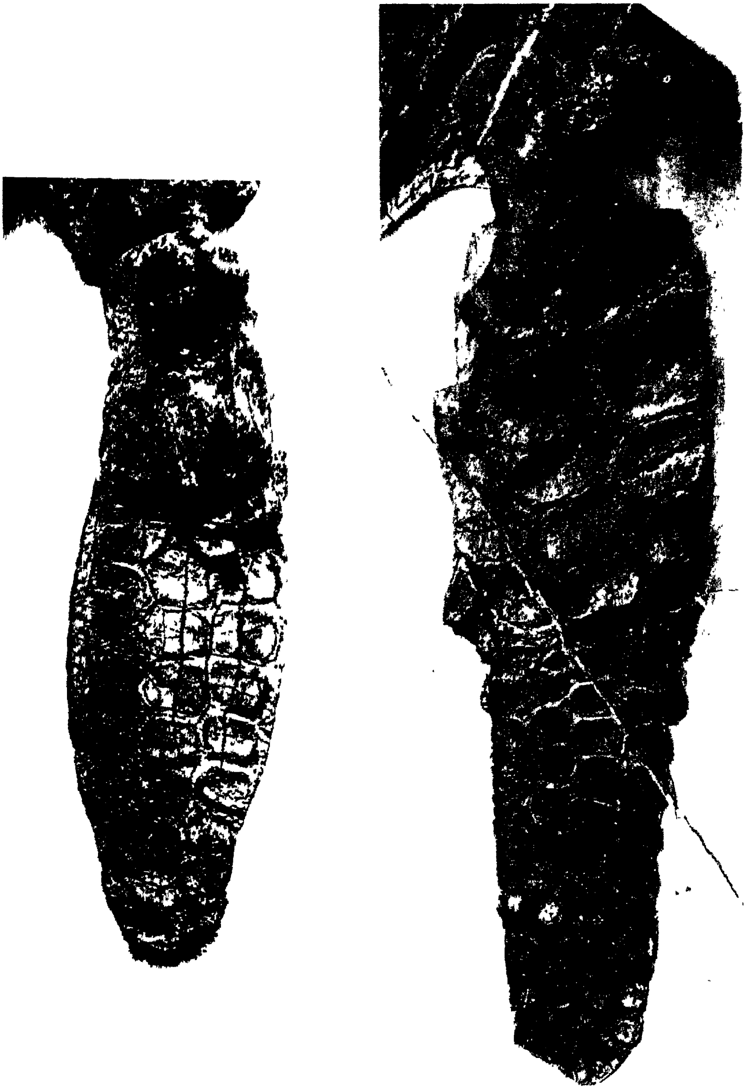
Ann. & Mag. Nat. Hist. S. 10. Vol. VI. Pl. XVI.



2.

DORSAL ASPECT OF (2) RIGHT PECTORAL AND (1) PELVIC LIMBS OF ICHTHYOSAURUS CRASSIMANUS, BLAKE (OWEN MS).

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 36. DECEMBER 1930.

LXX.—*New Species of African* Megalopidæ (*Col.*, *Phytophaga*).

By G. E. Bryant, Entomological Assistant, Imperial Institute of Entomology.

I now describe nine well-marked species of African Megalopidæ. There are at the present time about 90 described species from Africa, placed in seven genera. These are at present very badly defined, and simply separated on the shape of the prothorax, which is very unsatisfactory, as with more material for study we find these running one into the other. The species of Weise and Pic are only known to me from descriptions, so I think it wiser, until these have been examined, not to erect new genera.

Key to the Species of Colobaspis.

1 (18). Entirely reddish brown, with the legs and antennæ black.
2 (46). Antennæ short (normal).
3 (26). Dull, not shining or polished.
4 (9). Not clothed with grey pubescence.
5 (8). Elytra without pattern or spots.
6 (7). Head and prothorax reddish brown .... *murrayi*, Baly.
7 (6). Head black, with black markings on the prothorax .... *rustica*, Wse.

8 (5). Elytra with a pattern of transverse bands or spots.
9 (4). Clothed with grey pubescence.
10 (16). Prothorax red, with black markings.
11 (14). Prothorax red, with black basal markings.
12 (13). Elytra black, with red bands and spots .. *hargreavesi*, sp. n.
13 (12). Elytra black, with a red transverse band near the middle.
14 (11). Prothorax red, with the side-margins black.
15 (17). The apex of the elytra pale .... *nearei*, sp. n.
16 (10). Prothorax entirely grey-black.
17 (15). A pale spot at the apex of each elytron . *quadrimaculata*, Gah.
18 (1). Yellow-brown, with the apex of the elytra black, the apical black portion with the front margin almost straight.
19 (43). Size large, 11–14 mm.
20 (25). Elytra not carinate.
21 (22). Elytra strongly punctured .... *nyassæ*, sp. n.
22 (21). Elytra very finely and closely punctured.
23 (24). Apical black portion of the elytra with the front margin biangulate (fig. 2) .. *apicata*, Fairm.
24 (23). Apical black portion of the elytra with the front margin incurved.
25 (20). Elytra distinctly carinate .... *carinata*, sp. n.
26 (3). Shining and of polished appearance.
27 (30). Elytra black.
28 (29). A black spot on the head and the prothorax .... *lacordairei*, Westw.
29 (28). No black spot on the head or prothorax. *donckieri*, Pic.
30 (27). Elytra tinged with blue .... *ertli*, Wse.
31 (33). Elytra without dorsal impressions.
32 (34). Elytra black, with the apex pale ...... *latipennis*, Pic.
33 (31). Elytra subcompressed before the middle, and with dorsal impressions .... *jacobyi*, Wse.
34 (32). Elytra reddish brown, with two black spots at middle.
35 (36). Legs black, the hind femora with a small red spot......................... *centromaculata*, Jac.
36 (35). Hind femora almost entirely red.
37 (39). Elytra testaceous and feebly punctured.. *bicolor*, Jac.
38 (40). No frontal fovea.
39 (37). Elytra short and broad, rather strongly punctured........ .... *distincticollis*, Pic.
40 (38). A frontal fovea.
41 (42). Ferruginous, with the elytra black .... *dentipes*, Wse.
42 (41). Elytra with a dark central patch and with the apex pale .... *dollmani*, sp. n.
43 (19). Size small, 6 mm.
44 (45). Entirely reddish brown .... *variabilis*, Westw.
45 (44). Reddish brown, with the apex of the elytra black .... *parvula*, Westw.
46 (2). Antennæ very long, extending to the middle of the elytra .... *mashuana*, Jac.

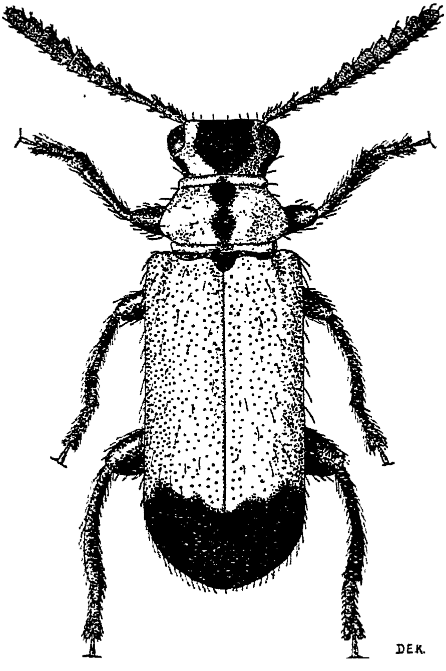
C. suturalis, Clav., from the description, appears to belong to the genus *Spondylia*.

Colobaspis nyassæ, sp. n. (Fig. 1.)

Oblong, convex, black, with the sides of the head and prothorax and the basal two-thirds of the elytra flavous, clothed with flavous and black pubescence. L. 13 mm.

Head not so broad as the prothorax at its widest, a large black macula, extending from between the eyes nearly to the base, strongly punctured and clothed with black pubescence, the sides and front of the head flavous, with rather finer punctures and scattered pubescence, the apex of the mandibles and palpi black. Antennæ black, extending well beyond the base of the elytra, first joint long, about equal to the third, but broader, the second half as long as the third and nearly equal to the fourth, the four basal joints with long black pubescence, the fifth to the tenth stouter and subserrate, the eleventh longer with the apex pointed, the seven terminal joints clothed with short ashy pubescence. Prothorax transverse, slightly nitid, with a

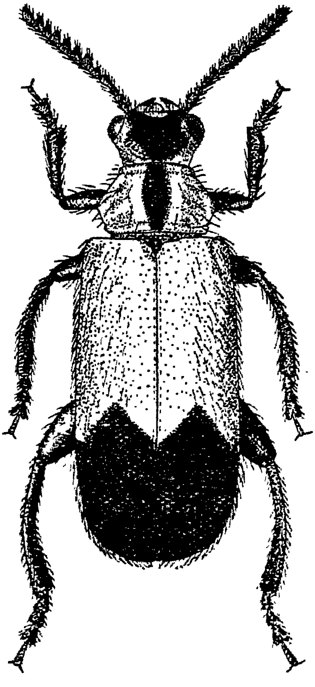
Fig. 1.



Colobaspis nyassæ, sp. n.

black median longitudinal vitta and the sides broadly flavous, clothed with yellow pubescence and with a few scattered punctures, broadest behind the middle and narrowed in front. Scutellum black, truncate at apex and with a few large scattered punctures. Elytra elongate, nearly parallel-sided, rounded at the apex, the basal two-thirds flavous, and the apex black, strongly and closely punctured, the flavous portion clothed with flavous pubescence and the black apical portion with black. Underside black, with long scattered pubescence, the apical ventral segment the longest, the ♀ with a deep impression. Legs black, the ♂ with the hind femora strongly incrassate.

Fig. 2.



Colobaspis apicata, Fairm.

Nyasaland : Mlanje, 23. xii. 1913, 2. i. 1914 (*S. A. Neave*), 121 examples.

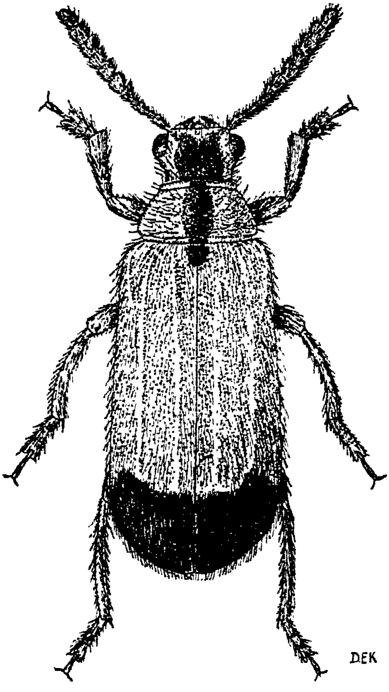
Type in the British Museum.

This is evidently a variable species, judging by the long series before me; some have the elytra almost entirely black, with the basal portion showing flavous to a varying degree, and a few lacking the black vitta on the prothorax. It is closely allied to *C. apicata,* Fairm. (fig. 2), but is a much larger species, with the puncturation of the elytra much stronger.

Colobaspis carinata, sp. n. (Fig. 3.)

Oblong, convex, pubescent, the underside black, head testaceous with a large black macula, prothorax testaceous with a black median vitta, elytra testaceous with the apex black, two carinæ on each. L. 12–13 mm.

Fig. 3.



Colobaspis carinata, sp. n.

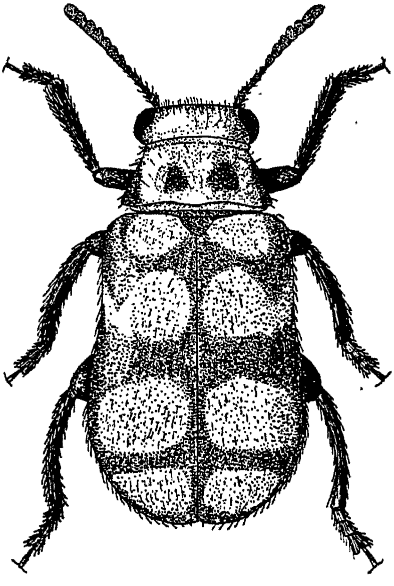
Head narrower than the base of the prothorax, testaceous, broadly maculate from between the antennæ to the base, with an impression on the vertex, rugosely punctured. Antennæ black, extending a little beyond the base of the prothorax, the first joint long and about equal to the second and third together, the fourth shorter than the third, subtriangular, the fifth to the tenth very transverse and subserrate, the eleventh less transverse and with the apex pointed. Prothorax testaceous, broadest just before the base and narrowed in front, with a black longitudinal median vitta, with scattered punctures and pubescence. Scutellum black, truncate at the apex. Elytra twice as long as broad, the sides parallel and rounded at the apex, testaceous, with the apex black, the anterior margin of the black portion incurved, two longitudinal carinæ on each strongly and irregularly punctured. Underside and legs black, clothed with black pubescence.

Northern Rhodesia: Solwezi District, xi. 1916 (*H. C. Dollman*), 6 examples.

Type in the British Museum.

Allied to *C. apicata*, Fairm. (fig. 2), but easily distinguished by the carinate elytra and the curve of the black apical patch, and its less nitid appearance.

Fig. 4.



Colobaspis hargreavesi, sp. n.

Colobaspis hargreavesi, sp. n. (Fig. 4.)

Oblong, very convex, orange-red, covered with short grey pubescence, the metasternum tinged with black, the sides of the prothorax and two patches on the disc black, the elytra with three irregular transverse black bands, the margins black with the exception of the basal portion, legs black with the hind femora partly red. L. 8 mm., br. 4 mm.

Head orange-red, strongly punctured above, almost impunctate in front, with short scattered greyish pubescence, a distinct fovea in the middle between the eyes, the mandibles blackish. Antennæ black, with the two basal joints red, extending to the base of the prothorax, the first joint about three times as long as the second, and about equal to the third, the fourth about equal to the second, the fifth a little longer and triangular, the sixth to the tenth transverse, subserrate, the eleventh a little longer and rounded at the apex.' Prothorax orange-red, transverse, narrowed in front, strongly angulate near the base, strongly punctured with the exception of a small patch on the disc, the sides edged with black, and the greyish pubescence stronger at the sides, two black subtriangular patches narrowly separated on the disc. Scutellum black, slightly pubescent, with a few punctures at the sides, truncate at the apex. Elytra convex, closely punctured and thinly covered with short greyish pubescence, with three transverse black bands, the basal portion orange-red, the sides and suture black, enclosing on each elytron four irregular orange-red patches. Underside orange-red, sparsely punctate and pubescent, the metasternum tinged with black, the pleuræ of the meso- and metathorax strongly punctured, the first four ventral segments about equal to each other. Legs black, with the hind femora more incrassate, and red in the central portion.

UGANDA: Kiryanga, 30. iv. 1927 (*H. Hargreaves*), 1 ♀. KENYA COL.: Yala River, Kakumga Forest, 4800–5000 ft., 21–28. v. 1911 (*S. A. Neave*).

Type in the British Museum.

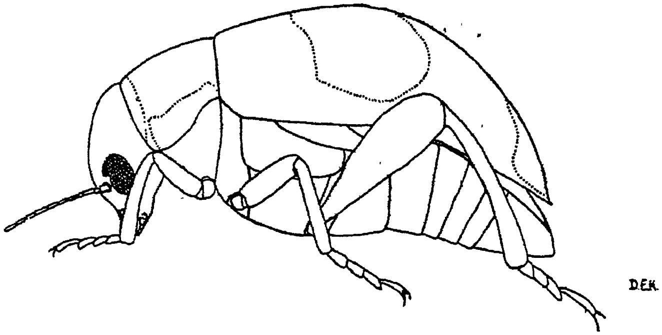
Near *C. quadrimaculata*, Gah.

Colobaspis neavei, sp. n. (Fig. 5.)

Oblong, very convex, orange-red, covered with short grey pubescence, with the anterior margin and sides of the prothorax and the legs black, the elytra black, with two large orange-red patches before the middle and the apex creamy white. L. 10 mm., br. 5 mm.

Head orange-red, closely and finely punctured, a deep fovea in the middle behind the line of the eyes, covered with short grey pubescence. Antennæ short, fuscous, extending to the middle of the prothorax, the three basal joints light red, the first joint long and about equal to the second and third together, the fourth shorter than the third, the fifth to the eleventh transverse and subserrate. Prothorax orange-red, with the anterior margin outlined with black, and the sides margined with black, strongly angulate close to the base, and narrowed in front, finely and not closely punctate, and covered with short grey pubescence. Scutellum orange-red, pubescent, punctate, truncate at the apex. Elytra convex, broadest behind the middle, black with two orange-red patches in front of the middle, and the apical portion creamy white, covered with short grey pubescence, finely and closely punctate, with the exception of the white apical portion. Underside orange-red, with the ventral segments darker, with scattered pubescence; the last ventral segment with a deep depression at the apex in ♀. Legs black and very pubescent.

Fig. 5.



Colobaspis neavei, sp. n.

Uganda: Mpanga Forest, Toro, 4800 ft., 13–23. xi. 1911 (*S. A. Neave*), 1 ♀.

Type in the British Museum.

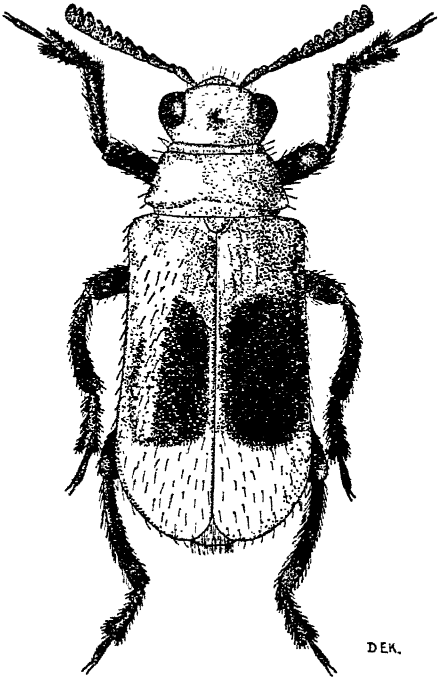
Allied to *C. quadrimaculata*, Gah., but of shorter and broader build and different pattern. These two new species and *C. quadrimaculata* in their colouring bear a strong resemblance to the African species of Coccinellidæ of the genus *Epilachna*.

Colobaspis dollmani, sp. n. (Fig. 6.)

Broadly elongate, ferruginous, nitid, with blackish pubescence above, pale yellow below, four black maculæ on the meso- and metasternum, the antennæ and legs black, with the exception of the hind femora, which have the median portion reddish, the elytra ferruginous, with the median portion fuscous, and the apical third stramineous. L. 11–16 mm., br. 5–6 mm.

Head ferruginous, nitid, with scattered black pubescence, almost impunctate, the palpi and mandibles fuscous, a deep depression on the vertex behind the eyes. Antennæ black, with black pubescence, extending almost to the base of the prothorax; the first joint long, about twice as long as the second, and about equal to the third, the fourth shorter than the third and subtriangular, the fifth to the tenth transverse and subserrate. Prothorax ferruginous, nitid, transverse, narrowed in front, angulate close to the base, clothed with scattered black pubescence, impunctate. Scutellum ferruginous and truncate at the apex. Elytra ferruginous, the median portion fuscous, and the apical third stramineous, slightly broader at the baae than the prothorax, widest

Fig. 6.



Colobaspis dollmani, sp. n.

behind the middle, the shoulders well marked, and a strong impression behind the scutellum, feebly and irregularly punctured, clothed with scattered black pubescence. Underside ferruginous, clothed with scattered yellow pubescence, meso- and metasternum with black maculæ. Legs black, with the exception of the hind femora which are ferruginous in the middle, the hind femora in the ♂ more incrassate.

NORTH-WESTERN RHODESIA: Chitambila, 11. xi. 1916; Mwengwa, 22. xi. 1913 (*H. C. Dollman*), 8 examples.

Type in the British Museum.

Allied to *C. jacobyi*, Wse., but differs in colour, the angles at the base of the prothorax less well marked, and the antennæ shorter and more transverse.

Key to the Species of Antonaria.

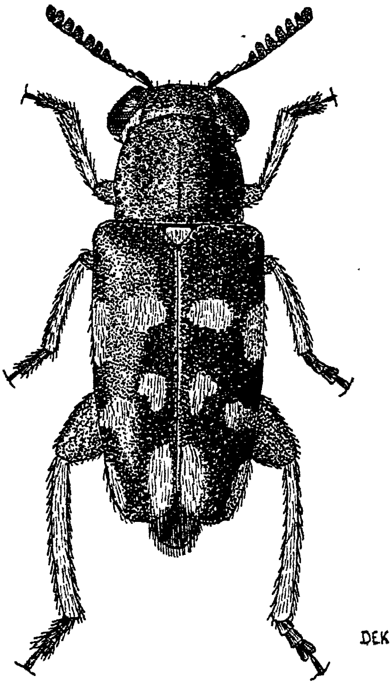
1 (28). Prothorax rounded at the sides.
2 (17). Elytra with spots or transverse bands formed of greyish or yellow pubescence.
3 (16). Elytra piceous or dark reddish testaceous, with the base rust-coloured.
4 (12). Elytra not nitid.
5 (9). Elytra with six pubescent patches.
6 (8). Elytra finely punctate.
7 (15). Prothorax with the sides and a median longitudinal line pubescent .... *varicolor*, Jac.
8 (6). Elytra strongly punctate .... *longicollis*, Wse.
9 (5). Elytra with four pubescent patches.
10 (11). Pubescence forming patches and not connected........................ *bisbimaculata*, Pic.
11 (10). Elytra with grey pubescence forming a connected pattern .... *murina*, Westw.
12 (4). Elytra piceous and nitid.
13 (14). The spots or patches not elongate...... *quadrinotata*, Pic.
14 (13). Elytra with two elongate testaceous spots *humeralis*, Wse.
15 (7). Sides of the prothorax reddish and pubescent .... *coriacea*, sp. n.
16 (3). Elytra fulvous or flavous, entirely clothed with yellow pubescence........... *hirsuta*, Jac.
17 (2). Elytra without spots or transverse bands.
18 (23). Pubescence whitish grey, not yellow.
19 (22). Elytra with grey pubescence along the suture.
20 (21). Prothorax with the sides and a longitudinal central line pubescent ...... *modesta*, Jac.
21 (20). Prothorax covered with whitish hairs.
22 (19). Elytra with trace of white hairs at the suture near the apex .... *ugandensis*, sp. n.
23 (18). Prothorax with dense yellow pubescence at the sides and at the suture of the elytra .... *femorata*, Clav.

24 (25).	Elytra pale, with the suture and sides dark	*villosa*, sp. n.
25 (24).	Elytra entirely ivory-colour.	
26 (27).	Antennæ reddish.....................	*fulvicornis*, Jac.
27 (26).	Antennæ black	*senegalensis*, Westw.
28 (1).	Prothorax with a notch behind the middle, elytra dingy yellow with large black or fuscous punctures..........	*nigropunctata*, sp. n.

Antonaria coriacea, sp. n. (Fig. 7.)

Elongate, blackish, underside with white pubescence, the sides of the prothorax reddish, head with one and the prothorax with three longitudinal yellow pubescent bands: elytra with two irregular transverse grey pubescent bands, one before and the other behind the middle, the suture at the apex shortly margined with white pubescence. L. 8 mm., br. 3 mm.

Fig. 7.



Antonaria coriacea, sp. n..

Head coriaceous, with a vague median yellow pubescent stripe and thick white pubescence behind the eyes. Antennæ black, extending to the base of the prothorax, the first joint long, about equal to the second and third together, the second about equal to the fourth, the fifth to the tenth transverse, the eleventh less so. Prothorax coriaceous, about as long as broad, slightly widened in the middle, narrowed in front, the sides reddish, clothed with yellow pubescence, also a median longitudinal yellow stripe. Scutellum clothed with long whitish pubescence. Elytra blackish coriaceous, clothed with very fine grey pubescence, and with two irregular transverse bands of thicker white pubescence, one in front and one behind the middle, and the suture at the apex margined with white pubescence. Underside clothed with thick golden pubescence, the first four apical ventral segments about equal to each other. Legs reddish, with white pubescence, the tarsi darker, the hind femora strongly incrassate in ♂.

UGANDA: Tero, 10. vii. 1912 (*C. C. Gowdey*), 1 ♂.

Type in the British Museum.

Allied to *A. varicolor*, Jac., but much smaller, with a different pattern and the base of the elytra dark.

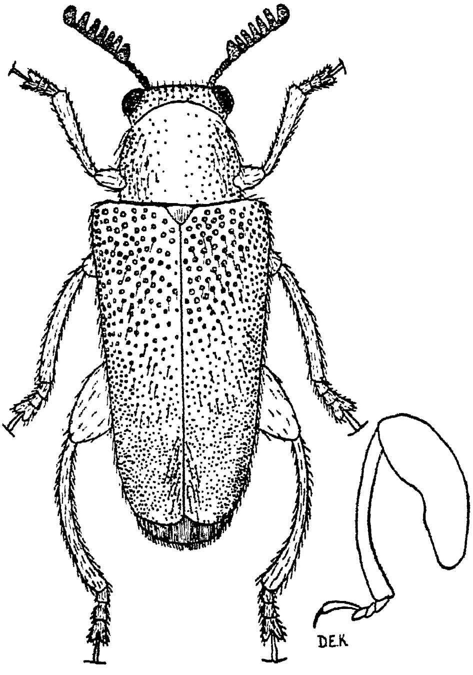
Antonaria nigropunctata, sp. n. (Fig. 8.)

Elongate, fuscous or blackish, head clothed with fine golden and grey pubescence; prothorax with the sides clothed with grey pubescence, the elytra pale dingy yellow, with large fuscous or black punctures, clothed with scattered grey pubescence. L. 8 mm., br. 3½ mm.

Head fuscous, strongly punctured, with a median longitudinal interrupted impunctate line, transversely impunctate in front of the eyes, a rugose patch near the inner margin of the eyes, clothed with fine golden pubescence, and with coarser greyish pubescence behind the eyes. Antennæ black, short, not extending to the base of the prothorax, the four basal joints more nitid, the first and third long, the second and fourth short, the fifth to the terminal joint transverse. Prothorax about as broad as long, slightly widened behind the middle and contracted near the base, covered with large scattered punctures, the sides clothed with long grey pubescence. Scutellum fuscous, triangular, clothed with long greyish-white pubescence. Elytra not quite twice as long as broad, widest at their base, and narrowed to the apex, of a dull yellowish tinge, covered with round fuscous-black punctures, finer at the apex, clothed with greyish-white and fuscous pubescence, a white patch on the suture near the apex, and a vague oblique patch near the middle. Legs fuscous, the ♂ having the hind femora longer than the ♀ and strongly bent, forming a notch on the underside. The ♀ is slightly blacker in colour.

UGANDA: Kampala, 30. viii. 1915 (*C. C. Gowdey*); W. Ankole, 4500–5000 ft., 14. x. 1911 (*S. A. Neave*).

Fig. 8.



Antonaria nigropunctata, sp. n.

S. NIGERIA: Ibadan, 5. vi. 1923 (*A. W. J. Pomeroy*); Old Calabar (Baly Coll.).

Type in the British Museum.

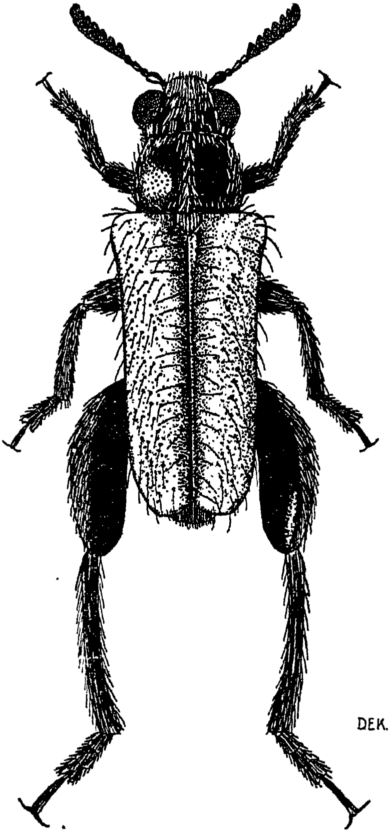
Easily distinguished from the other described species by the black punctures on the elytra.

Antonaria villosa, sp. n. (Fig. 9.)

Elongate, black, clothed with long greyish-white and black pubescence; the elytra fulvous, narrowly margined with black, the suture rather broadly fuscous, the median portion having a greyer appearance than the base and apex. L. 9 mm.

Head black, nearly as broad as the prothorax, evenly punctured, more rugose near the inner margin of the eyes, and clothed with long greyish-white pubescence; the clypeus separated from the face by a transverse groove. Antennæ black, short, not extending to the base of the prothorax, the four basal joints more glabrous than the seven terminal, the first joint broader and nearly as long as the second and third together, the second short and about equal to the fourth, the seven terminal joints very much broader and duller, the fifth subtriangular, the sixth to the tenth very transverse,

Fig. 9.



Antonaria villosa, sp. n.

the eleventh pointed at the apex and less transverse. Prothorax black, strongly punctured, transverse, with the sides rounded, the anterior and posterior margins sulcate, the sides and a median longitudinal line clothed with long greyish-white pubescence, the disc on each side of the median line clothed with long scattered pubescence. Scutellum black, clothed with greyish-white pubescence. Elytra about twice as long as broad, narrowed to the apex, broader at the base than the prothorax, strongly punctured, fulvous, with a narrow black margin, except near the shoulders, the suture rather broadly fuscous, and the middle portion with a distinct grey tinge, clothed along the suture with greyish-white pubescence, the remainder with long black pubescence. Underside and legs black, clothed with long greyish-white pubescence, the hind femora more incrassate in the ♂.

N.W. RHODESIA: Kashitu, xi. 1914 (*H. C. Dollman*). NYASALAND: Zomba (*H. S. Stannus*), 6 examples.

Type in the British Museum.

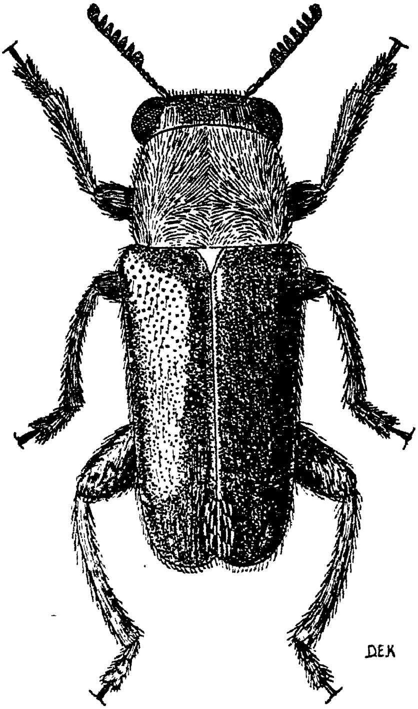
Closely allied to *Antonaria fulvicornis*, Jac., and *Leucastea senegalensis*, Westw., which should be placed in the genus *Antonaria*. Differs in colour and the much longer pubescence. In Ann. & Mag. Nat. Hist. 1923, p. 133, I sank *A. fulvicornis* as a synonym of *L. senegalensis*; I now think I was wrong, as it differs in the colour of the antennæ and puncturation of the prothorax. Jacoby says head and thorax impunctate, but they are distinctly punctate, more so on the head, but finer than in *L. senegalensis*.

Antonaria ugandensis, sp. n. (Fig. 10.)

Elongate, entirely black, punctate, with the prothorax clothed with dense white pubescence; the underside and legs less densely clothed with yellowish-white pubescence. L. 9 mm., br. 3 mm.

Head black, punctate, about as broad as the prothorax, longitudinally impressed on the vertex to the base, the clypeus with long whitish pubescence. Antennæ short, black, the four basal joints more nitid than the seven terminal; the first long, about as long as the second and third together, the second about equal to the fourth, the fifth broader and subtriangular, the sixth to the tenth very transverse and subserrate, the eleventh narrower, less transverse, with the apex pointed. Prothorax black, about as long as broad, closely punctate, the puncturation closer and finer than on the head, clothed with dense white adpressed pubescence, the sides nearly straight, slightly narrowed in front, at their widest about as broad as the head. Scutellum black, clothed with dense white pubescence. Elytra black, about twice as long as broad, at the base slightly broader than the prothorax, and a little attenuate to the apex, strongly punctured, more so than on the prothorax, clothed with fine blackish pubescence, the sutural margin just before the apex with white pubescence. Underside and legs black, clothed with yellowish pubescence. ♂ with the hind femora a little more incrassate than the ♀. The ♀ with the last ventral segment deeply impressed.

Fig. 10.



Antonaria ugandensis, sp. n.

Uganda: Mabira Forest, 3500–3800 ft., 16. vi. 1911 (*S. A. Neave*); Ruwenzori, 10,000 ft., 14. v. 1911 (*C. C. Gowdey*); Entebbe, 21. iv. 1914 (*C. C. Gowdey*).

Allied to *A. modesta*, Jac., but the head is less constricted behind, size smaller, puncturation different, and the prothorax covered entirely with white pubescence.

LXXI.—*Results of the Oxford University Expedition to Greenland, 1928.—Araneæ and Opiliones collected by Major R. W. G. Hingston; with some Notes on Icelandic Spiders.* By A. RANDELL JACKSON.

[Plate XVII.]

THE following is a list of Spiders and Opiliones captured by Major Hingston in Greenland during August 1928. They were all obtained in West Greenland, in the Godthaab Fjord, at a locality called Kugssuk and at about 30 feet above sea-level, except a small number from a neighbouring place called Matuola. Two places were searched here, one at 2000 feet above sea-level and the other at sea-level. In the first locality three species were obtained: *Lycosa grœnlandica*, Thor., *L. glacialis*, Thor., and *Araneus grœnlandicus*, Sim. At the second or low level *Lycosa grœnlandica*, Thor., *L. furcifera*, Thor., *Oxyptila dura*, Sör., *Thanatus arcticus*, Sör., and *Drassodes signifer*, C. L. K. All the remainder may be regarded as coming from one locality. The collector, Major Hingston, is publishing an account of their habits.

I also include here the description of a new species, some notes on Arctic Erigones, some notes on Icelandic spiders, and complete lists of Greenland and Iceland species known. These, of course, are compilations from the works of Professor Strand, Prof. Sörensen, Dr. de Lessert, Dr. E. Schenkel, Mr. J. Braendegaard, and others.

I have to thank for their kind assistance Professor Strand of Riga, Mr. Louis Fage of Paris, Mr. Braendegaard of Copenhagen, and Professor Crosby of Cornell University, New York. Also, of course, Professor Poulton of Oxford for all the trouble he has taken in supplying me with the material and with much information and general assistance.

SPIDERS COLLECTED IN GREENLAND.

Dictyna major, Menge.

Dictyna hamifera, Thor.
Dictyna borealis, Camb.
Dictyna arenicola, Camb.
Dictyna grœnlandica, Lenz.

There would appear to be only one species of *Dictyna* in Greenland, and the name *D. major*, Menge, has priority. The specimens are brownish and dull in colour, resembling somewhat *D. arundinacea*, L., in this respect. *D. arenicola*, Camb., of Scotland, is almost black and white, being very distinctly marked, but there is no difference in the sexual organs. I was fortunate enough to add this species to the French list by taking a female at Hardelot Plage in 1918. That specimen resembled the Scots examples, but is on the small side. *D. borealis*, Camb., was described as having the eyes of the anterior row equidistant (19), whilst Thorell said that the median eyes of his *D. hamifera* were for the most part farther apart than each from its lateral (34). There is some colour variation too, some examples having very distinctly annulated legs, others only faintly or hardly annulated. These, however, have their eyes either as in *D. hamifera*, Thor., or *D. borealis*, Camb.

Sörensen (28) says, "Nevertheless, I have seen specimens coloured like *D. borealis* with eyes arranged as in *D. hamifera* and *vice versa*." There seems no doubt that all these forms are conspecific, which is also the view of Simon, who also said of the species, " elle est à rechercher dans les dunes du Nord de la France " (23).

The present collection includes one adult male, a number of adult females, and a larger number of young of various ages. The species occurs in East Prussia, Holland, France, and Scotland.

Drassodes signifer, C. L. K.

An adult of each sex, the female with egg-sac, and a few immature examples. The adults are rather larger and darker than typical British specimens, but show no structural difference. This is the only known *Drassodes* from Greenland. It has a wide European and Asiatic distribution, and occurs in Iceland and the Faroe Islands.

Oxyptila dura, Sör. (25). (Pl. XVII. fig. 6.)

Two adult females and two juveniles were taken. Mr. Jens Braendegaard kindly compared a female with Sörensen's types and confirmed my identification. The vulva varies even in the two present females. In the one not figured the central process is constricted about the middle and expanded distally, whilst the small ducts seen through it assume a semicircular position, instead of being only slightly curved. The spines on the under side of the tibiæ and metatarsi vary in number not only in individuals, but on the two sides of the same individual.

Thanatus arcticus, Sör. (25).

About half a dozen specimens, all immature. However, this is the only *Thanatus* known to inhabit Greenland, so the identification is probably correct. Whether the species is a good one—which I doubt—I am not competent to decide.

Trochosa alpigena, Dol.

Trochosa biunguiculata, Camb.

A single male. This corresponds well with a specimen of Cambridge's species taken by me in Scotland and identified by Mr. Pickard-Cambridge himself. The Greenland example is a little smaller and less brightly coloured, but differs in no other respect. Occurs also in Grinnell's Land, Iceland, and Switzerland.

Lycosa hyperborea, Thor. (35). (Pl. XVII. fig. 9.)

Two females of this spider, which is of the *tarsalis-monticola* group. Finland, Prussia, Norway, and Sweden, but not apparently in Arctic America.

Lycosa glacialis, Thor. (34).

One adult female and several immature examples. Also another adult female and immature examples taken in August 1926 by Mr. Remy of the 'Pourquoi Pas,' captured in Liverpool Island, East Greenland, latitude 71°, in 1926. This spider reaches 2000 feet on the sides of Godthaab Fjord.

Lycosa grœnlandica, Thor (34).

Four adult males, three adult females, and forty immature examples. This spider also reaches an altitude of 2000 feet. It resembles a big darkly-coloured *L. amentata*, Clerck, but the sexual organs are entirely different.

Lycosa furcifera, Thor. (36).

Ten adult males, eight adult females, and eighteen immature examples. This is a very pretty species with yellow coxæ and much yellow in its legs. The thoracic bands and abdominal markings are all bright yellow, whilst the ground-colour is nearly black. The lateral thoracic bands are entire. The central band is very characteristic. From behind, it runs forward to the occiput, where it divides into two branches forming a segment larger than a semicircle and embracing the caput. Hence the specific name.

This and the two last species belong to a group not closely related to any of our British forms. They are probably American, although the last two reach Iceland.

Theridion lundbecki, Sör. (25). (Pl. XVII. fig. 10.)

Two adult and two immature females. This species is peculiar to Greenland, but is a typical *Theridion* not unlike *T. varians*, Hahn, or *T. denticulatum*, Walck. Its vulva is, however, characteristic. Mr. Braendegaard kindly confirmed my identification by comparing a specimen with Sörensen's types in Copenhagen.

Enoplognatha intrepida, Sör. (25). (Pl. XVII. fig. 7.)

Theridion intrepidum, Sör.

Three females. This is a typical *Enoplognatha*. In the female cheliceræ there are two teeth on the anterior margin, as well as the dentiform projection on the angle of the proximal joint. The proximal tooth is very small, the distal one larger. On the posterior margin there is one strong black tooth nearer the base of the fang. The specimens were accompanied by their egg-sacs when sent.

Mr. Braendegaard, by comparing these specimens with Sörensen's types, kindly prevented me from describing the species as new, which I certainly should otherwise have done. Sörensen's description of the spider, and especially of its vulva, appears very unlike the real thing. I give a figure of the sexual organs to prevent further misunderstanding.

Erigone whymperi, Camb. (19).
(Pl. XVII. figs. 1 & 4.)

About a dozen adults of both sexes and some immature individuals. The species occurs in Arctic America and Iceland, and reaches 69° 13′ at Jakobshavn in North Greenland. See note *postea*.

Erigone atra, Bl.

One typical male, a rather small specimen. A very widely distributed Holarctic species. All Europe, Northern and Central Asia, Lapland, Faroës, Azores, United States, Canada. Not yet in Iceland. Reaches the summits of mountains in Britain.

Typhochrestus borealis, sp. n.
(Pl. XVII. figs. 8, 11, 12, 13, 14.)

A single female. I have, however, an adult and several immature males from Disko Island, lat. 69°, West Greenland, the exact locality being Godhavn. They were taken on August 28, 1921. Mr. W. S. Bristowe sent them to me, having obtained them from Professor Seward of Cambridge University. I feel sure that the female from Godthaab in the present collection is conspecific with these Disko males, and describe it here. Whether *Typhochrestus* is the correct genus I do not know.

In my opinion, the subdivision of the Erigoneæ has gone much too far, and we want fewer genera instead of more. The present species corresponds well generically, except for the secondar sexual modification of the male caput, with *T. digitatus*, Camb., the type. *T. spetsbergensis*, Thor., is quite another thing, and is much nearer *Hilaira* and *Coryphæolanus*.

Hilaira frigida, Thor.

A single female, rather small and dark. Arctic America, Jan Mayen, Iceland, Faroes, Britain, Norway. Other alpine localities doubtful. In Britain a mountain spider only.

Tetragnatha extensa, L.

Tetragnatha grœnlandica, Thor. (34).

The present collection includes one male and three females, all adult, with numerous immature examples of varying ages. These, I have no doubt, are the *T. grœnlandica* of Thorell, afterwards more fully described by Sörensen. Nevertheless, I can find no constant difference between these Greenland specimens and *T. extensa*, L.

The specimens are all rather small and deeply pigmented. Their colouring tends towards brown, especially in the middle of the dorsal abdominal folium, which in young examples becomes reddish brown and in one case almost red. The legs are rather short, but not more so than can sometimes be seen in British specimens, amongst which brownish examples can occasionally be found.

The distance between the two rows of eyes is the same both for centrals and laterals. In the male, which was measured, the central anteriors were ·15 mm. removed from the central posteriors, the anterior laterals being exactly the same distance from the posterior laterals. In the females the distances were not measured, but were approximately the same as in the male. According to Sörensen (26), the lateral eyes were farther apart than the anterior and posterior centrals in Danish and Scandinavian specimens of "*T. grœn-*

landica." He gives no measurements, but I dare say some variation is possible, and in any case this is really the only character he does give to separate this species from *T. extensa.* Unfortunately, in his dichotomous table he uses this character to separate *T. grœnlandica* from *T. extensa*, and, having done this, stresses the differences between *T. grœnlandica* and *T. obtusa*, C. L. K., which are many and obvious. Of course, these Scandinavian specimens may represent another species, and neither Thorell nor Sörensen ever saw an adult *Tetragnatha* from Greenland (34).

The male in the present collection was found *in cop.* with one of the females, and in both of these specimens a slight difference was observed from typical *T. extensa.* This was in the falcal armature. In both sexes the arrangement of teeth at the apex of each falx was exactly as in *T. extensa,* and the curved dorsal spine on the male falces corresponded well. There was, however, a reduction in the number of the very small proximal teeth, one or two of these minute denticles being absent.

Counting the small lobe-like blunt projection near the insertion of the fang, *T. extensa* should have in both sexes *eight* teeth on each margin of the fang-groove. In the Greenland specimens aforesaid the male had *six* teeth on each margin, the two very small proximal ones being absent. In the female there were *six* anterior and *seven* posterior teeth. In another female there were six on each margin in the right falx, six anterior, and seven posterior on the left one. In the third female, however, which was the largest and best developed, there were eight teeth on each margin of each falx, and these were exactly similar to those of *T. extensa.* The sternum in the Greenland specimens is almost black with a yellow central macula as in *T. extensa.* The palpi showed no difference from those of *T. extensa.* So there appear to be no constant tangible differences between *T. grœnlandica* and *T. extensa*, and I therefore sink the former name as a synonym of the latter.

It is, of course, just possible that Greenland may contain two species of *Tetragnatha.* But as no one has described an adult from this country until now, and as these specimens cannot with certainty be differentiated from *T. extensa*, a spider with a wide distribution in both hemispheres including Alaska, Labrador, and Siberia, I feel it is the only course. Nor do the Greenland specimens appear to be worth a subspecific name, unless a large series of adults were shown to possess the slight diminution of falcal teeth above described constantly.

Araneus grœnlandicus, Sim. (24).

Two adults and one subadult specimen, all females, were taken. It is closely allied to *A. albovittatus*, Westr., but differs a little in coloration and quite distinctly in the vulva. Of this organ Simon's original description is better than that of Sörensen.

Araneus ocellatus, Clerck.

Araneus patagiatus, C. L. K.

Three adult males and thirteen adult females. The Greenland examples of this species were called var. *særensenii* by Strand (31). But the crochet of the vulva varies very much in position and elevation with the changes in the sexual cycle, and my specimens, at any rate, do not deserve a varietal name. Distribution Holarctic. All Europe, Siberia, Turkestan, Labrador, Iceland, Canada, Alaska, Newfoundland, United States.

Araneus quadratus, Clerck.

Nine adult females. Strand (31) called his Greenland specimens var. *grœnlandicola*, on account of their smaller size and darker coloration and structure of the sternum. In these respects, however, my specimens seem very like our British examples. *A. quadratus*, Clerck, is widely distributed in the Palæarctic area. All Europe from Lapland, and northern Norway to the Mediterranean, Siberia, Kamtschatka, and Siberia.

Mitopus morio, Fabr.

Oligolophus alpinus, Herbst.

One male and three females (adult), with six juveniles, which are probably of the same species. This is the only Opilionid known to inhabit Greenland. Roewer (20) does not maintain *O. alpinus*, Herbst, as that of a subspecies or even a race. Of Holarctic distribution.

In the present paper nineteen species of Spider and one Opilionid are listed from Greenland. These fall into four groups:—

(1) Species so far peculiar to Greenland, 6:

Oxyptila dura, Sör.
Thanatus arcticus, Sör.
Theridion lundbecki, Sör.
Enoplognatha intrepida, Sör.
Typhochrestus borealis, sp. n.
Araneus grœnlandicus, Sim.

(2) Species common to Greenland and America, not occurring elsewhere, 4:

Erigone whymperi, Camb.
Lycosa furcifera, Thor.
Lycosa grœnlandica, Thor.
Lycosa glacialis, Thor.

The first three, however, reach Iceland, but are not recorded further east.

(3) Species occurring in Greenland and the Palæarctic area, but not in America, 4:

Drassodes signifer, C. L. K.
Dictyna major, Menge.
Araneus quadratus, Clerck.
Lycosa hyperborea, Thor.

The first three reach Britain amongst other places.

(4) Holarctic species, 6:—

Hilaira frigida, Thor.
Erigone atra, Bl.
Tetragnatha extensa, Linn.
Araneus ocellatus, Clerck.
Trochosa alpigena, Dol.
Mitopus morio, Fabr.

All these occur in Britain, and are very widely distributed animals. Two of the list are new to the fauna of Greenland, viz., *Typhochrestus borealis*, sp. n., and *Erigone atra*, Bl. Including these two, fifty species are now recorded for Greenland. Four of these, however, seem to be bad. These are *Erigone modesta*, Thor., described from immature examples, *Erigone penessa*, Thor., described from a single female, *Erigone longipalpis*, Sund., probably a mistake for *E. arctica*, White, and *E. grœnlandica*, Lenz., a doubtful species.

This leaves us with forty-six more or less good species, of which exactly half are Linyphiids, the other half belonging to the other families, with one Opilionid.

The present collection includes only four Linyphiids and sixteen of the other families. None of these species occur in Spitzbergen. Eight are found in Iceland, viz., *Erigone whymperi*, Camb., *Hilaira frigida*, Thor., *Araneus ocellatus*, Clerck, *Drassodes signifer*, C. L. K., *Lycosa furcifera*, Thor., *L. grœnlandica*, Thor., *Trochosa alpigena*, Dol., and *Mitopus morio*, Fabr. One of these (*Hilaira frigida*, Thor.) occurs in Jan Mayen, while nine, as has been said above, reach Britain.

Turning to the total list of forty-six species, we find twenty-two species peculiar to Greenland, nine occur also in America (some reaching Iceland), seven occur in the Palæarctic area, whilst eight are Holarctic. Three species are common to Greenland and Spitzbergen, viz., *Erigone psychrophila*, Thor., *Erigone arctica*, White, and *Typhochrestus spetsbergensis*, Thor. The first of these is found also in the far remote Franz Josefland, where it is the only Spider known.

NOTE ON THE GENUS *ERIGONE*.

An important work on this genus appeared in 1928. This is the "Revision of the Spider Genera *Erigone*, *Eperigone*, and *Catabrithorax* (Erigoneæ)" by C. R. Crosby and Sherman C. Bishop, published by the University of the State of New York. This is the most important work on the subject since Kulczynski's "Erigoneæ Europææ addenda ad descriptiones" published in Cracow in 1902. In the American paper four species found in Europe, including Iceland, are figured. There seems to be some misunderstanding somewhere about the distinct species called by Kulczynski *Erigone arctica*, White. Simon in 1926 (23^2) (posthumous work) considered it as synonymous with *Ellatra*, Bl., and the American writers believed that what they called *E. arctica*, White, was probably different from ours. To settle this I have this year sent British specimens of *Erigone arctica*, White, to Professor Crosby. He has kindly compared them with specimens from arctic America, and states that he can find no difference. This spider is thus of holarctic distribution. It is well figured by both Kulczynski and Professor Crosby.

Messrs. Crosby and Bishop give excellent figures of the male sexual organs, but only rough ones of the vulvæ. Yet when cleared and examined transparently these are seen to be very extraordinary. I include a figure of that of *E. dentipalpis*, Wid., a very common European spider. It will be seen that the female organs are built up in the same way as those of *Leptyphantes* and the allied genera. In other words, that the spermathecæ open on the one hand into a sort of vestibule, and on the other each emits a long duct, which running round the edges of the covering-plate or operculum opens near its fellow on the lower edge. This is exactly what occurs in the Leptyphantoid genera, but I cannot say whether it denotes relationship or convergence.

In the male, at any rate, there is nothing that corresponds in position with the lamella characteristica of *Leptyphantes*. In other species of *Erigone* which I have examined, the details vary a little, but the general arrangement is the same.

E. whymperi, Camb., is a very interesting American species, reaching Greenland and Iceland. It belongs to a group of alpine and arctic forms, characterized by the arrangement of dens medius and dens posticus of the embolic division (*vide* Crosby and Bishop (5)) of the palpi. In these species the dens medius runs transversely across the palpus. Its anterior border is curved, the posterior toothed. The dens posticus is almost parallel with it, but generally more obliquely placed. The nearest ally of *E. whymperi*, Camb., is *E. cristatopalpus*, Simon, from the French and Swiss Alps. I include drawings of this from specimens kindly lent me by Mr. Louis Fage, of the Paris Museum. Here it will be seen that the dens posticus is much less oblique, being in fact very nearly transverse, and the dorsal projection of the palpal tibia is more abrupt and approaches more to the vertical. *E. psychrophila*, Thorell, is a larger spider, but more nearly resembles *E. whymperi* in its palpi. The enormous and strongly-curved patellar apophyses, however, easily distinguish it. These apophyses are nearly as long and nearly as curved in *E. welchii*, Jackson (13), but here the dens medius is very different—it is very broad, and quite distinct in shape, bearing a large lobe instead of teeth on its posterior border.

In *E. tenuimanus*, Sim., from the Alps, which is a very small species, the palpi are very slender, though the dens medius and dens posticus are much as in *E. whymperi*. The dorsal projection of the palpal tibia is, however, very slight. This is still slighter in *E. tirolensis*, L. Koch, and here there is a difference in the dens anticus of the palpal organs, which is hardly angled at all on its inner border near the apex as seen from below. The angle is very distinct in all the other species. *E. tirolensis*, L. K., is so far not known from Greenland or America. It occurs in Tyrol, Switzerland, Spitzbergen, Siberia, Novaya Zembla, and reaches its western limit in Iceland, and a female probably of this species was obtained in Jan Mayen, so it ought to occur in Greenland. I figured the sexual organs of male and female in 1914 (6), but had at that time not many females. The epigynal plate seldom differs as much from that of other species as I then thought, but I still believe it can generally be distinguished.

Typhochrestus borealis, sp. n.
(Pl. XVII. figs. 8, 11, 12, 13, 14.)

Length.—Male 1·15 mm.; female 1·6 mm.

Colour.—Cephalothorax yellowish brown with a fine reticulation of dark lines. Male much darker than the female, but otherwise similar. At the occiput is a dark pentagonal macula, pointed behind and slightly crescentic in front. From this mark issue four dark lines. The three which are in front run forwards, the central one to a point midway between the posterior central eyes, the lateral ones to the posterior lateral eyes. The fourth line issues from the posterior pointed end of the macula and runs backwards, and ends in another macula—lozenge-shaped in the male, oval in the female. From these two maculæ dark lines radiate to the edges of the cephalothorax, where they join a dark marginal band surrounding it. The sternum is dark yellowish brown sprinkled with pale yellow spots. Labium yellow-brown in the female, darker in the male. The abdomen also a yellow-brown, dotted with paler yellow spots, about the middle of the upperside. These arrange themselves into a series of pale yellow chevrons, diminishing in size towards the spinners. On the underside are two parallel indistinct yellow lines running from points just behind the spiracles to the region of the spinners.

The falces, palpi, and legs are yellow-brown in the female, similar but somewhat streaked and mottled with brown pigment in the male.

Cephalothorax.—In the female this is oval, markedly hollowed in its posterior slope, the hollow beginning at the level of the posterior macula, and corresponding with the coxæ of the third pair of legs. Ocular area rounded, and much longer than the height of the clypeus.

In the female the eyes are arranged in two rows. The posterior row is curved, concave in front. The eyes are subequal and almost equidistant, and the centrals very slightly farther apart than each is from its adjacent lateral. The anterior row is slightly curved, concave behind. Centrals darker than the laterals and slightly smaller. Each is less than half a diameter apart, and only a little further removed from its adjacent lateral.

The male cephalothorax is much modified and the arrangement of the eyes thereby altered. The eyes are arranged in two rows. They are smaller and further apart than in the female. The posterior row is curved, concave in front, the centrals at least a diameter apart and nearer together than each is to its adjacent lateral. The anterior row is very much curved and concave in front. The centrals are very dark and much smaller than the laterals. They are almost in contact. Each is quite two diameters removed from its adjacent lateral.

The interocular area is nearly black, covered with hairs, which at its posterior part are long and backwardly directed. The area is raised into a high conical projection, on the front and back slopes of which are placed the anterior and posterior central eyes. There are no post-ocular depressions behind the lateral eyes. The clypeus is much higher than the ocular area in a straight line, and higher, even if the slopes of the ocular area are included. In its lower part it is slightly hollowed, and its profile runs forwards and upwards. A little below the level of the lateral eyes it forms a rounded protuberance or boss, and then runs upwards and backwards to the level of the anterior lateral eyes, which mark the junction of clypeus and ocular eminence.

The posterior slope of the cephalothorax is at first very gradual, but it is markedly hollowed behind at the level of the posterior macula before described.

Sternum.—Heart-shaped.

Falces.—In the female the outer borders are faintly concave, almost straight. The internal borders are divergent. Anterior teeth large and widely spaced, four in number. Posterior teeth, four also, very minute and close together. In the male the falces are similar, only darker. On the one side four minute posterior teeth were seen, but only three could be found on the other. Anterior teeth as in the female.

Maxillæ inclined towards the labium.

Palpi in the female similarly coloured to the legs. No terminal claw.

Male palpus.—Femur and patella coloured as the legs. Tibia produced into a flat dorsal apophysis projecting forwards over the tarsus, its angles salient, the interior one produced further forward than that on the exterior. The apophysis is rather darker than the rest of the article, which it nearly equals in length. Tarsus of normal form. Paracymbium inconspicuous. Lamella characteristica not present. The embolus is short, black, and curved into a tight spiral with the point projecting forwards.

The legs show no femoral or metatarsal spines. Each patella bears one above. Each of the tibiæ of the first three pairs possesses two dorsal spines. The fourth tibia on each side wants the distal spine and thus possesses only one.

Trichobothria are present on the metatarsi of the first three pairs about the middle. None occur on the fourth metatarsi.

Tarsal claws three in number. Inferior claw simple. Superior claws armed with about six teeth arranged in a single row, and diminishing in size upwards, the sixth or proximal tooth being very small indeed.

Spinners and *spiracles* normal.

Epigyne.—Simple and inconspicuous (Pl. XVII. fig. 8).

The female of this species resembles *Typhochrestus digitatus* in size, facies, and general structure. It also resembles the male in most respects. The ocular arrangement and cephalothorax of the male are, however, far from typical. It is, of course, possible that they belong to different species, and they were certainly found some hundreds of miles apart. I believe, however, that they are conspecific and that they are more nearly related to *Typhochrestus* than any other genus.

LIST OF GREENLAND SPIDERS UP TO DATE.

Excluding *Erigone penessa*, Thor., *E. modesta*, Thor., *E. longipalpis*, Sund., and *L. grœnlandica*, Lenz., 46 species of Araneæ and Opiliones are now known to inhabit Greenland. Of these 23 belong to the Linyphiidæ and 23 to the other families:—

Dictyna major, Menge. 4, B.
Drassodes signifer, C. L. K. 4, B.
Gnaphosa islandica, Sör. 1 (occurs also in Iceland).
Trochosa alpigena, Dahl. 3, B.
Lycosa glacialis, Thor. 2 (with Iceland).
—— *grœnlandica*, Thor. 2 (with Iceland).
—— *furcifera*, Thor. 2 (with Iceland).
—— *hyperborea*. 4.
Tegenaria detestabilis, Camb. 2.
Hahnia glacialis, Sör. 1.
Oxyptila dura, Sör. 1.
Xysticus deichmanni, Sör. 1.
Thanatus arcticus, Sör. 1.
Salticus scenicus, Clerck? 3, B.
Theridion lundbecki, Sör. 1.
—— *petrense*, Sör. 1.
Stearodea bipunctata, L. 4, B.
Enoplognatha intrepida, Sör. 1..
Tetragnatha extensa, L. 3, B.
Araneus grœnlandicus, Sim. 1.
—— *quadratus*, Clerck. 4, B.
—— *ocellatus*, Clerck. 3, B.
Brachycentrum simile, Sör. 2.
Erigonella grœnlandica, Strand. 2.

Cnephalocotes pygmæus, Sör. 1.
Areoncus ruderalis, Sör. 1.
Walckenaera insolens, Sör. 1.
—— *similis*, Sör. 1.
Typhochrestus borealis, Jackson. 1.
—— *spetsbergensis*, Thor. 4.
Gonatium inflatum, Sör. 1.
Œdothorax lapidicola, Sör. 1.
Notioscopus? *curvitarsus*, Sör. 1.
Erigone atra, Bl. 3, B.
—— *arctica*, White. 3, B.
—— *psychrophila*, Thor. 3.
—— *whymperi*, Camb. 2 (with Iceland).
Minicia gibbosa, Sör. 1.
Hilaira frigida, Thor. 3, B.
Oreonetides vaginatus, Thor. 4, B.
Tmeticus levinsoni, Sör. 1.
Leptyphantes turbatrix, Camb. 1.
—— *grœnlandicus*, Thor. 1.
—— *audax*, Sör. 1.
Linyphia emertoni, Thor. 2.

Mitopus morio, Fabr. 3, B.

The numbers affixed are as follows:—1 Peculiar, 2 Nearctic, 3 Holarctic, 4 Palæarctic, B British.

It will be seen that thirteen species are common to Greenland and Britain. Simon in 'Histoire Naturelle des Araigneés,' Tome ii. p. 343, states that *Pirata piratica*, Clerck, is found in Spitzbergen and in Northern Greenland. Strand repeats this in 'Fauna Arctica,' p. 467. I can find no record of this anywhere, nor did the Oxford Expeditions get it in Spitzbergen. I think there must be some mistake about it, so have not included it in the above list nor in my Spitzbergen papers.

NOTE ON SOME ICELANDIC SPIDERS.

My friend, Mr. W. S. Bristowe, recently sent me some spiders, collected in 1926 by Mr. Remy, who was apparently cruising in a ship called the 'Pourquoi Pas.' He called at Greenland, at any rate—at Liverpool Island, where he found specimens of *L. glacialis*, Thor., as recorded above. He also did some collecting near Reykjavik in Iceland, where he obtained four species of spiders in August of that year. These are:—

Halorates reprobus, Camb. Both sexes.
Leptyphantes mengii, Kulcz. Both sexes.
Hilaira frigida, Thor. One female.
Porrhomma thorellii, Herm. One female.

These were all found on the shore near Reykjavik. The first two are apparently new to Iceland, and should bring the total of its spider fauna to 39 species. The *Leptyphantes mengii* do not exactly resemble the species as seen in Britain. They are larger and have the facies of *L. tenuis*, Bl. The tooth on the paracymbium of the male is stronger and projects more forwards than upwards, but I cannot make out any other difference in the sexual organs except size. According to Simon and his editors (23[3]) this species is absent in France, where it is replaced by *L. gallicus*, Sim.

Through the kindness of Mr. Louis Fage, who has given me a pair of specimens, I have been able to compare *L. mengii*, Kulcz., *L. gallicus*, Sim., and these Icelandic examples. The tooth on the paracymbium varies, *L. gallicus* being intermediate in strength and forward direction between *L. mengii* from Britain and the Icelanders. I noticed a slight difference between the vulva of *L. gallicus* and the Iceland example, but on examining a series of *L. mengii* it became evident that this organ varied a good deal, and specimens were found resembling both forms together with intermediate examples. In size, too, *L. gallicus* is intermediate between the tiny *L. mengii* and the larger Icelanders. The Icelanders at present have a very boldly marked black and white pigmented abdominal pattern. Long immersion in spirit will, however, reduce this considerably. There seems no constant difference, except size, between the specimens of *L. mengii*, Kulcz. (from Britain), *L. gallicus*, Sim., and these Iceland forms.

I here append a list of Iceland spiders up to date. Professor Strand has kindly sent me a copy of his 'Isländische Arachniden,' published at Stuttgart in October 1906. Amongst those he recorded in 'Fauna Arctica' in June 1906 he removes *Tmeticus affinis*, Bl., and *Nemastoma lugubre*, O. F. M., as it seems they were recorded from the Faroës and got into the Iceland list by mistake. Including one Opilionid, there were 26 species known in 1906. In 1913 de Lessert (18) added one more, *Pardosa riparia*, C. L. K., subspecies *sphagnicola*, Dahl. In 1929 J. Braendegaard (1) added ten more. I now record two new ones here, so that the total number of species of Araneæ and Opiliones known to inhabit Iceland is 39, as follows :—

Gnaphosa islandica, Sör.
Drassodes signifer, C. L. K.
Xysticus cristatus, Clerck.
—— *pini*, Hahn.
Tegenaria derhami, Scop.
Trochosa alpigena, Dahl.

Pirata piraticus, C. L. K.
—— *piscatorius*, Clerck.
Lycosa riparia, C. L. K., subsp. *sphagnicola*, Dahl.
—— *pullata*, Clerck.
—— *tarsalis*, Thor., var. *islandica*, Strand.
—— *herbigrada*, Bl.
—— *grœnlandica*, Thor.
—— *furcifera*, Thor.
Stearodea bipunctata, L.
Diplocephalus cristatus, Bl.
Savignyia frontata, Bl.
Entelecara erythropus, Westr.
Tmeticus ? sp., Sim.
Gonatium rubens, Bl.
Erigone whymperi, Camb.
—— *longipalpis*, Sund.
—— *tirolensis*, L. K.
—— *arctica*, White, and var. *maritima*, Kulcz.
Halorates reprobus, Camb.
Phaulothrix hardii, Bl.
Leptorhoptrum huthwaitii, Camb.
Hilaira frigida, Thor.
Porrhomma thorellii, Herm.
Leptyphantes zimmermannii, Bertk.
—— *cristatus*, Menge.
—— *mengii*, Kulcz.
Bolyphantes index, Thor.
Mengea scopigera, Gr.
Araneus diadematus, L., var. *islandicus*, Strand.
—— *ocellatus*, Clerck, var. *islandicolus*, Strand.
—— *sericatus*, Clerck.
—— *cornutus*, Clerck.

Mitopus morio, Fabr.

All these occur in Britain, except *G. islandica*, Sör., *Erigone whymperi*, Camb., *Lycosa grœnlandica*, Thor., *Lycosa furcifera* Thor., and the subspecies *sphagnicola*, Dahl, of *L. riparia*, C. L. K., of which the type occurs. The first four of these are found in Greenland, but not in Europe. It is thus seen that 87 per cent. of the fauna of Iceland occur in Britain, compared with only 28 per cent. of the fauna of Greenland.

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EXPLANATION OF PLATE XVII.

Fig. 1. *Erigone whymperi*, Camb. Right palpal tibia from outer side.
Fig. 2. *Erigone cristatopalpus*, Sim. Right palpal tibia from outer side.
Fig. 3. *Erigone dentipalpis*, Wid. Epigyne, cleared and seen transparently. Semidiagrammatic. 1, spermatheca; 2, spermathecal gland; 3, seminal tube; 4, aperture of same; 5, vestibule.
Fig. 4. *Erigone whymperi*, Camb. Right palpus from below. *a*, dens anticus; *b*, dens medius; *c*, dens posticus; *d*, embolus.
Fig. 5. *Erigone cristatopalpus*, Sim. Right palpus from below. Lettering as in the last.
Fig. 6. *Oxyptila dura*, Sör. Vulva from below.
Fig. 7. *Enoplognatha intrepida*, Sör. Vulva from below and slightly behind.
Fig. 8. *Typhochrestus borealis*, sp. n. Vulva from below.
Fig. 9. *Lycosa hyperborea*, Thor. Vulva from below.
Fig. 10. *Theridion lundbecki*, Sör. Vulva from below.
Fig. 11. *Typhochrestus borealis*, sp. n. Left palpal organs from outer side. *p*, paracymbium; *e*, embolus.
Fig. 12. *Typhochrestus borealis*, sp. n. Left palpus from outer side, slightly different position.
Fig. 13. *Typhochrestus borealis*, sp. n. Male cephalothorax from left side.
Fig. 14. *Typhochrestus borealis*, sp. n. Right palpus from above.

LXXII.—*Papers on Oriental* Carabidæ.—XXIV.
By H. E. Andrewes.

The following descriptions of new Carabidæ from Sumatra will, I think, together with those appearing elsewhere in another memoir, complete those I was anxious to publish in anticipation of a projected catalogue of the species of that island. I hope, however, to prepare a few tables for the differentiation of the species of such genera as are largely represented or present any difficulties regarding determination.

Clivina pfisteri, sp. n.

Length 5–5·5 mm.

Piceous; palpi, joints 1 and 2 of antennæ (rest a little darker), and legs light ferruginous.

Head with prominent eyes, median part of clypeus deeply emarginate, angulate at extremities, wings slightly rounded, separated from median part by a deep notch and placed rather farther back; a smaller notch between wings and frontal plates, the latter convex, bordered, and rounded; clypeus transversely raised and flattened behind, the suture moderately deep; frontal impressions deep, facial carinæ short but well marked, facial sulci fairly deep; neck constriction punctate, shallow but entire; a large pore on vertex, the surface surrounding it generally uneven, and always more or less punctate; labrum truncate, 7-setose, mandibles only moderately sharp; mentum with the tooth carinate beneath, shorter than lobes; antennæ moniliform, joint 2 evidently longer than 3. *Prothorax* convex, quadrate, very slightly longer than wide, sides parallel, with a finely crenulate border, hind angles with a tooth, the pore a little removed from margin, sides of base straight; median line and front transverse sulcus clearly marked, latter reaching margin at extremities, surface with a few fine striæ and punctures. *Elytra* moderately convex, rather more than twice as long as wide, shoulders square, sides parallel; striæ deep and minutely punctate, 1 joining 2 at base, 3 free, 4 joining 5, 6 and 7 ending farther back, striole rather short; intervals convex, 3 with four conspicuous pores adjoining stria 3, 8 carinate at both ends. Prosternum striate at sides, a few punctures towards middle, the process with a fairly narrow sulcus. Venter rather closely and finely punctate, except along median line, the two pores adjacent. Profemora dilated, sulcate and bidentate (including trochanter); protibiæ lightly sulcate, with three slender digitations and an upper tooth; mesotibiæ with a long spine at apical third.

Very near *C. lobata*, Bon., and similar both in form and colour, but the head is punctate, the neck-constriction entire, and the prothorax evidently longer.

Negri Bahroe, Bila Sumatra (*Dr. C. R. Pfister*—coll. B. H. Klynstra), 4 ex. Mr. Klynstra has kindly allowed me to retain the type in my collection.

Tachys brunniceps, sp. n.

Length 2·5–2·7 mm.

Testaceous, elytra sericeous; head and a vague sutural streak on the elytra brown.

Head with two fairly deep furrows, diverging behind, eyes rather flat, mentum with two pores, antennæ rather long and filiform, joint 2 longer than 3. *Prothorax* cordate, not quite a half wider than long, base truncate, wider than apex, sides well rounded and sinuate a little before base, hind angles right, not very sharp, without carina; median line and basal sulcus both clearly impressed, latter finely crenulate, uninterrupted and without pore at middle, basal area vaguely striate. *Elytra* depressed, a third longer than wide, sides nearly parallel, border very finely setulose, rounding shoulder and reaching base of stria 4; fully striate, the striæ diminishing in depth from within outwards, the four inner ones moderately deep, finely crenulate, 5 to 7 very lightly impressed, all reaching base, or nearly so, 1 and 2 reaching apex, where 2 is deeper, diverges from 1, and is sometimes interrupted, 8 rather vague in front, deep behind, striole fairly long, on middle of elytron, hooked in front, the pore near apex; front dorsal pore on interval 6 at about a third, hind one just behind the hook of the striole. Microsculpture of elytra and prothorax consisting of transverse lines so fine as to be practically invisible (× 80), the vertex with a reticulation of moderately transverse meshes. Prosternal process slightly sulcate, metasternal process narrowly bordered.

Very near the Javanese *T. sundaicus*, Andr., but with a brown head, more prominent eyes, much wider elytra, the striæ deeper, farther apart, and much more evidently crenulate.

Negri Bahroe, Bila Sumatra (*Dr. C. R. Pfister*—coll. B. H. Klynstra), 19 ex. Mr. Klynstra has kindly allowed me to retain the type in my collection.

Callistomimus asper, sp. n.

Length 4·5–4·75 mm.

Black; prothorax above and beneath, mesosternum, and an area surrounding scutellum, embracing intervals 1 to 3 on each side and extending back to the front fascia, red; palpi (except near apex), joints 1 to 3 of antennæ, more or less, legs (except knees), and two slightly oblique fasciæ on each elytron yellowish white. The front fascia is narrow and extends from stria 3 to 8 ; the hind one is a little wider and extends between 2 and 8.

Head convex, shining, very coarsely punctate, clypeus, neck, and a small area on middle of the front smooth, eyes prominent, antennæ thick, reaching basal fourth of elytra. *Prothorax* very convex, cordate, both a little wider than head and a little wider than long, sides bordered and strongly rounded, the long spiniform hind angles projecting outwards and backwards considerably in advance of the base, which is narrower than apex; median line inconspicuous, basal foveæ fairly deep, near the angles, surface closely and coarsely punctate. *Elytra* convex, fully a half wider than prothorax and fully a third longer than wide, shoulders rather square, faintly dilated behind, apex subtruncate; striæ deep, and some very coarse punctures are visible here and there, but the whole surface is broken up by short deep transverse furrows between the striæ, so that it is coarsely asperate, like a rasp. Sterna very coarsely, venter finely and much more sparsely punctate. Body pubescent.

Allied to *C. rubellus*, Bates, but smaller and even more coarsely sculptured, especially the asperate elytral surface. Head relatively smaller and much more coarsely punctate ; prothorax of a darker red, much narrower, and much more coarsely punctate ; elytra narrower, the fasciæ smaller, the scutellary patch not extending back beyond the front fascia.

Lau Rakit (*J. B. Corporaal*), 300 metres, 28. viii. 1921, 3 ex. The type is in the British Museum.

Amblystomus chalceus, sp. n.

Length 3·25 mm.

Dark æneous above, piceous beneath; palpi, joint 1 of antennæ (remaining joints fuscous), and legs ferruginous.

Head large, frontal foveæ obsolete, front margin of clypeus bordered and emarginate, labrum more deeply emarginate, the left side in each case in advance of the right, the basal membrane of the labrum hardly exposed, eyes large, moderately prominent, antennæ rather slender, extending a little beyond base of prothorax. *Prothorax* only a little wider than head, a half wider than long, sides narrowly bordered and reflexed, with a seta at apical third, rounded in front, then very nearly straight to the hind angles, which are obtuse, reflexed, and strongly rounded ; median line very fine, transverse impressions and basal foveæ all present but rather shallow. *Elytra* somewhat flat, subrectangular, though slightly dilated behind, sharply rounded at apex, a half wider than prothorax and as much longer than wide; striæ fine and almost imperceptibly crenulate, outer ones faint, but 8 deeper towards base and apex, intervals nearly flat, 3 with a small pore at three-fourths, adjoining stria 2. Microsculpture of the elytra formed by very irregular meshes, which on average are moderately transverse; on the basal half of the prothorax the meshes are similar but finer, but in front and on the head they are isodiametric; there are also sparse microscopical punctures all over the upper surface.

Not unlike *A. dromioides*, Bates, in size, form, and striation, but in that species joint 2 of the antennæ is pale, the femora are piceous, and there are two flavous spots on each elytron; in addition the hind angles of the prothorax are more conspicuous, while the microsculpture of the elytra is much coarser, the meshes being very little wider than long.

Atjeh-Idi (*J. B. Corporaal*), 2 ex. These are in Mr. B. H. Klynstra's collection, but he has kindly allowed me to retain the type.

Lesticus lautus, sp. n.

Length 23·5 mm., width 8 mm.

Black, shining; head and prothorax metallic green with slight purplish reflections, elytra purple, extreme apex of palpi ferruginous.

Head convex, neck faintly constricted, frontal foveæ deep, some irregular striation within them and at sides, eyes moderately prominent, genæ inconspicuous, sloping gently to neck, maxillary palpi slender, last joint of labial palpi (♂) dilated at apex, but between two and three times as long as wide, antennæ extending rather beyond base of prothorax. *Prothorax* moderately convex, strongly declivous near front angles, two-fifths wider than head, a fourth wider than long, base truncate, rather narrower than apex, sides bisetose, sharply rounded in front and strongly sinuate at a sixth from base, border thick, but narrowing in front, front angles somewhat rounded, hind angles right, projecting very faintly laterally and a little rounded; median line extremely fine, transverse impressions faint, basal foveæ deep, impunctate, close to angles, surface generally smooth, with faint cross-striation. *Elytra* moderately convex, nearly a fourth wider than prothorax and nearly three-fourths longer than wide, widest a little behind middle, basal border hardly extending inwards beyond stria 5; striæ finely punctate and moderately deep, rather deeper at sides, 1 arising in an umbilicate pore, a disconnected pore on each side of scutellum;

intervals slightly convex on disk, more convex at sides, 7 and 8 subcostate near apex, 3 with two pores, the front one at a fifth, adjoining stria 3, the other at about middle and on the interval. The microsculpture of the elytra is formed by isodiametric meshes; the prothorax and head are practically without any. Pro- and metasterna deeply sulcate; mes- and metepisterna, sides of metasternum, and base of venter with few but coarse punctures; metepisterna about a third longer than wide; last ventral segment (♂) with a single marginal pore on each side. Joints 1 and 2 of metatarsi outwardly sulcate; joint 5 throughout setulose beneath.

The species seems most nearly allied to *L. strictus*, Tchitch., but the size is much greater. The head and prothorax are similar in form, but the sides of the latter are sinuate further from base; the striæ are much deeper on the elytra and they are conspicuously punctate, the intervals more convex on disk, if not at sides, 7 and 8 subcostate near apex.

Batang Proepoe, Padangsche Bovenlanden, at about 1600 feet, Jan.–April 1898, 1 ex. ♂ in my collection. This was presented to me some years ago by Mr. T. G. Sloane, a second specimen being in his collection. A third specimen from the same locality (*J. Henzel*) is in the Leiden Museum.

Odacantha pusilla, sp. n.

Length 5·5 mm., width 1·3 mm.

Black, shiny; palpi and joints 1 and 2 of antennæ ferruginous, tibiæ, tarsi, a faint spot behind shoulder of each elytron, and venter brown, base of femora and a small round apical spot on each elytron yellowish white.

Head convex, eyes moderately prominent, genæ long, nearly straight, contracting gradually to the very narrow condyliform neck, frontal foveæ short and deep, diverging behind, two erect setæ on each side behind the two supra-orbital setæ, surface smooth, neck finely, transversely striate, antennæ nearly reaching middle of elytra. *Prothorax* long, cylindrical, dilated in middle, widest at two-fifths from base, wider behind than in front, much narrower than head, twice as long as wide, constricted slightly near apex, strongly before base, side-borders represented by a row of five or six long erect setæ, median line extremely fine, surface smooth. *Elytra* moderately convex, about a half wider than head, nearly twice as long as wide, shoulders oblique, but conspicuous, sides straight just behind base, thence gently widening, widest at apical fourth, apex on each side obliquely truncate; striæ barely traceable, odd intervals with rows of numerous pores and long upright setæ, surfaces smooth but with a deep depression on each side behind base, at bottom of which are some large pores. No microsculpture present. Underside impunctate, prosternal process bearing a fovea, metepisterna very long and narrow.

Very similar both in general appearance and coloration to *O. pilifera*, Nietn., but much smaller and narrower, the prothorax and elytra both relatively longer, and the latter with the basal depression shallower.

"Sumatra" (Deutsch. Ent. Mus.), 1 ex. Borneo, Pagat (*Grabowsky*), 1 ex. (type), presented to me some years ago by Mr. T. G. Sloane.

Mastax pygmæa, sp. n.

Length 2·75–3 mm., width 1·4–1·5 mm.

Black; palpi, joints 1 to 4 of antennæ (3 and 4 dark at apex), legs (except knees and tarsi), and three spots on each elytron pale flavous, underside piceous. The basal spot on the elytra is in the form of a curved band from stria 1 to stria 9, extending farthest back between the second and third costa; a second rounded spot at a third from apex adjoins the lateral margin, and is paler than the others; the third spot, which is very small, is near the inner apical angle.

Head wide and rather flat, frontal impressions fairly deep, linear, eyes moderately prominent, surface finely rugose and rather coarsely longitudinally striate, middle of front nearly smooth, antennæ thick, nearly reaching middle of elytron. *Prothorax* moderately convex, just narrower than head, and also just narrower than long, base gently arcuate, apex truncate, evidently wider than base, front angles a little advanced and fairly sharp, sides rounded, gently at first, then rather strongly, sharply sinuate at a sixth from base, hind angles sharp and projecting laterally; median line wide and deep, bounded on each side by a fine raised carina, surface coarsely and irregularly longitudinally striate. *Elytra* subquadrate, slightly convex, twice as wide as prothorax and a fourth longer than wide, sides gently rounded, apex truncate, with a faint re-entrant angle at the suture; three slightly raised longitudinal costæ, but no striæ visible, surface shagreened, the microsculpture formed by granules, which though irregular are on the whole longer than wide. The body generally is sparsely pubescent.

Very similar to *M. gestroi*, Bates, but smaller; head and prothorax similarly striate, but the median line on the latter more evidently bordered; elytra much more contracted towards base, the costæ less raised, the fascia in front thicker, the external lateral spot larger.

Palembang (*J. Bouchard*), 2 ex. in my collection. These were presented to me some years ago by Mr. René Oberthür, other specimens being in his collection. Two further examples from the same locality differ from the typical form in having the basal fascia on the elytra much reduced and interrupted. In the collection of the Leiden Museum there are a further seven specimens all coming from the same source; in one of these the prothorax is red.

Catascopus clarus, sp. n.

Length 9 mm., width 3·25 mm.

Bright metallic green above, elytra with the sutural area slightly cupreous, black beneath, with faint metallic reflections; basal joint of palpi and of antennæ, and femora pale ferruginous, joints 2 to 4 of antennæ dark ferruginous, rest of palpi, antennæ, and legs piceous.

Head wide, flat, clypeus broadly emarginate, labrum minutely emarginate at middle, frontal foveæ small and rounded, eyes large and prominent, surface closely striate-punctate, some more evident longitudinal striæ at sides, neck nearly smooth, slightly constricted at sides. *Prothorax* convex, subcordate, slightly narrower than head, a third wider than long, only slightly contracted in front, rather more so behind, sides with a narrow reflexed border, angulate at two-fifths from apex, almost straight from the apex to the angle and again from the angle to the sharp sinuation at a fifth from the base, front angles sharp and only slightly obtuse, hind angles right, sharp, a little reflexed and projecting laterally; median line very deep, transverse impressions and basal foveæ moderately deep, a slight rounded fovea on each side of disk at middle, surface rather strongly transversely-striate. *Elytra* subquadrate, moderately convex, two-thirds wider than prothorax, rather more than a half longer than wide, sides faintly sinuate behind shoulder, rounded behind, apex obliquely truncate, slightly emarginate on each side, outer angle of the emargination sharp though obtuse, inner one truncate to the width of interval 1; striæ deep, rather closely but not conspicuously punctate, the punctures disappearing near apex; intervals moderately convex in front, flatter behind, 4 a little wider than the rest near middle, none costate or carinate, 3 with three pores on the interval; surface minutely punctulate, a slight transverse depression behind base and on each side near apex. Microsculpture formed by isodiametric meshes, very clear on elytra, faint on prothorax, and just visible on front of head. Prosternum and its process slightly and sparsely punctate and pubescent, venter even more faintly punctate and pubescent, apical segment (♂) with a slight emargination at middle, on each side of which is a pore and seta.

I know of no other Asiatic *Catascopus* with pale femora, though they occur elsewhere, *e.g.*, in the South African *C. rufofemoratus*, Chaud. About the size of *C. elegans*, Weber, but less convex, the head punctate-striate, the prothorax strongly transversely striate and with projecting hind angles, the elytra duller and somewhat sericeous, owing to the conspicuous microsculpture, the outer angles of the truncature obtuse but not rounded.

"Sumatra" (without more precise indication), 1 ex. ♂ in my collection. I am indebted for this to the kindness of Mr. M. Liebke.

Dolichoctis polygramma, sp. n.

Length 4·0–4·5 mm., width 1·6–1·8 mm.

Piceous to piceous-red; joints 1 to 4 of antennæ ferruginous, elytra black, with two large, rounded, ferruginous spots on each, one in front and one behind, covering approximately intervals 3 to 7.

Head convex, smooth, dull, with scattered microscopic punctures, frontal foveæ very small and shallow, eyes prominent, antennæ reaching a little beyond base of prothorax. *Prothorax* convex, a third wider than head, and nearly twice as wide as long, base bisinuate, apex emarginate, much narrower than base, sides finely bordered, conspicuously explanate and moderately reflexed, angulate just behind middle, faintly rounded in front and even more faintly sinuate behind, a large pore and seta on each side at the median angle and another just before base, hind angles right; median line fine, but deeper near base, front transverse impression obsolete, hind one deep, but not reaching sides, surface finely rugose-punctate except along each side of median line. *Elytra* convex, oval, about a half wider than prothorax, and as much longer than wide, apical truncature slightly emarginate on each side, the outer angle rounded; striæ fine and finely punctate, an additional stria between 1 and suture, and also between each adjoining pair of striæ, the duplicate striæ impunctate and very shallow on disk, though as deep as the normal striæ at sides, scutellary striole apparently continuing the duplicate sutural stria; intervals convex, 3 with two minute pores on apical half (all setæ abraded), marginal series interrupted. Microsculpture of elytra formed by moderately transverse meshes; that of head and prothorax deeply cut, the meshes isodiametric on the former and nearly so on the latter.

The identification of this species will offer no difficulties, for the duplication of the striæ is a character not only unique in this genus (so far as at present known) *, but presented by comparatively few genera among the Carabidæ.

North-East Coast, Serdang, vii.–x. 1921 (*I. van Leeuwen*, Leiden Mus.), 1 ex.; Liangagas (Stettin Mus.), 1 ex. I have also in my collection three examples, among them the type, from Sandakan in Borneo (*C. F. Baker*). In the British Museum there are four examples from South-East Borneo, in which the reduplicated striæ are very lightly impressed on the disk, and one example of the typical form from Perak (*Doherty*).

Two further examples in Mr. Klynstra's collection, from Medan and Lau Rakit (both *J. B. Corporaal*), are as large as *D. tetracolon*, Chaud. (5 mm.), and have similar large rounded spots on the elytra; each interval, however, has a faint longitudinal depression and the form of the prothorax is that of *polygramma*. A solitary specimen in the Deutsch. Ent. Museum resembles the Bornean examples of the British Museum.

Dolichoctis microdera, sp. n.

Length 5·5 mm.

Piceous; palpi, joints 1 to 4 of antennæ (rest fuscous), reflexed margins of prothorax and elytra, legs, and two small rounded spots on each elytron, front one on intervals 4 to 6, hind one on intervals 2 to 4, ferruginous.

Head convex, smooth, dull, frontal foveæ slight, a short longitudinal impression on middle of front, eyes moderately prominent, antennæ long and slender, reaching basal fifth of elytra. *Prothorax* small, cordate, moderately convex, barely wider than head, a fourth wider than long, base hardly wider than apex, its sides very oblique quite close to the angles, sides

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* True when this description was drawn up, but the same character is seen in another species, of which the description has recently appeared, viz., *D. multistriata*, Andr. (Ann. Mus. Civ. Gen. liii. p. 442).

narrowly reflexed, rounded in front and distinctly sinuate before base, no front pore or seta, but one on hind angles, which are reflexed and very obtuse and rounded, owing to the obliquity of sides of base; median line and transverse impressions all moderately deep, basal foveæ small and rounded, close to the angles, surface with some slight cross-striation. *Elytra* convex, subquadrate, two and a quarter times as wide as prothorax, rather less than a half longer than wide, apical truncature slightly emarginate on each side; striæ very fine, impunctate, a scutellary striole present; intervals flat, 3 very slightly raised at apex, with a single minute pore at three-fourths near the middle of the interval, surface smooth. Microsculpture of the elytra consisting in very fine transverse lines, which hardly form meshes; on the prothorax the meshes are moderately wide, and on the head isodiametric. The last ventral segment ♂ is emarginate at middle, and with a single pore and seta on each side.

Larger than *D. tenuilimbata*, Oberth., also from Sumatra, but similarly coloured, except that the elytra have smaller spots and a wider pale border. The antennæ are longer, the prothorax more contracted behind, the basal foveæ close to the angles, which are much more obtuse and rounded, the elytral striæ much finer and the apical truncature emarginate on each side.

"Sumatra" (*Weyers*), 1 ex. ♂ in my collection, received from Mr. T. G. Sloane.

The elytral dorsal pores in this and some other species of the genus are so microscopic as to be practically useless for purposes of differentiation.

Dolichoctis globosa, sp. n.

Length 3 mm., width 1·4 mm.

Piceous; palpi, joints 1 to 4 of antennæ, legs, and a small round apical spot on each elytron, on intervals 3 and 4, ferruginous.

Head small, convex, frontal foveæ small but fairly deep, surface nearly smooth in front, punctate and subrugose behind, eyes flat, antennæ reaching a little beyond base of prothorax. *Prothorax* convex, cordate, slightly wider than the head and as much wider than long, base truncate, evidently narrower than apex, which is bordered and slightly emarginate, front angles fairly sharp, sides narrowly bordered, well rounded in front and sinuate at a fifth from base, no lateral setæ, hind angles right, sharp, and projecting laterally; median line and transverse impressions fairly deep, basal foveæ elongate and moderately deep, and, on each side, a little in front and outside them, a second similar impression, also a rounded foveæ on each side of disk in front, to which this outer basal impression sometimes extends, surface otherwise smooth. *Elytra* convex, subglobose, two and a quarter times as wide as prothorax, a fourth longer than wide, very obliquely truncate and slightly pointed at apex; striæ fairly deep and coarsely punctate, not nearly reaching base, a short scutellary striole present; intervals convex, 3 with two small pores at or just before middle and at fourth-fifths, surface smooth. The only microsculpture present is on the head, where there are some indistinct isodiametric meshes.

The species is unlike any hitherto described in the genus, the relatively small head and prothorax, with a large subglobose hind body, and deep, coarsely punctate, elytral striæ, being unusual features. Nevertheless, the characters presented by the buccal organs, antennæ, and claws are all those of *Dolichoctis,* and I have in my collection examples of other Malay species, not yet described, which in their form do not differ greatly from that now in question.

S.W. Coast: Boekit Gabah (*H. Lucht*), 4 ex. Type in the British Museum; cotypes in the Amsterdam Zoological Museum and in my collection.

Dolichoctis torquata, sp. n.

Length 5 mm.

Black; antennal joints 1 and 2, with base of 3 and 4, apex of palpi, prothorax (above and beneath), margins of elytra (including interval 9), and legs (tibiæ darker) pale ferruginous.

Head convex, smooth, dull, frontal foveæ shallow, a sharp longitudinal carina on each side near eye, eyes moderately prominent, antennæ reaching basal fifth of elytra. *Prothorax* convex, nearly two-thirds wider than head and as much wider than long, widest at or just before middle, sides of base slightly oblique, apex deeply emarginate, front angles rounded, sides bisetose, widely explanate, and slightly reflexed behind, rounded in front, nearly straight behind, hind angles reflexed, very obtuse but only slightly rounded; median line and front transverse impression both moderately marked, hind transverse impression fairly deep, basal foveæ small and rounded, surface nearly smooth on disk, some vague large punctures, mingled with smaller ones, on the explanate margins and basal area. *Elytra* moderately convex, subovate, not quite a half wider than prothorax, a third longer than wide, apex on each side obliquely truncate and slightly emarginate; striæ moderately deep, impunctate, intervals nearly flat, a little convex at sides, 3 with two minute pores on apical half, slightly dilated close to apex, surface smooth. Microsculpture of elytra and prothorax consisting of transverse lines, forming on average very wide meshes, though narrower ones are mingled with them, the meshes on the head isodiametric.

Evidently near *D. expansicollis*, Bates, which is unknown to me in nature. Larger and apparently much wider, the colours a little different, and notably the prothorax uniformly ferruginous. The hind angles of the prothorax are only slightly, not strongly rounded, but both species have a longitudinal carina on each side of the head, and in both the elytra are without any pattern.

"Sumatra" (Deutsch. Ent. Mus.), 3 ex. The type is in the Deutsch. Ent. Museum.

LXXIII.—*Notes on Nomenclature of some Neotropical* Chrysomelidæ (*Coleoptera*), *with Descriptions of Two new Species.* By R. J. A. W. LEVER, B.Sc.

(A) THE nomenclature of *Diabrotica vittata* (Fabr., 1775) and of *D. melanocephala* (Fabr., 1798) is not yet clearly determined despite a recent paper by Houser and Balduf (1) on the damage by the former to cucumbers in the U.S.A. and on the synonymy of these beetles.

The beetle known to-day as *D. vittata* was described as *D. melanocephala* by Fabricius in 1775, and has been seen by the author in the Banks Collection to answer to the original description (2) "elytris pallidis, vitta media nigra," etc. This specific name occurs on p. 118 of the 'Systema Entomologiæ,' and therefore has page-priority over *D. vittata* used on p. 122 of the same volume.

The name of the beetle known to-day as *D. melanocephala* from Fabricius's description of 1798 cannot, in view of the above, have any status, so it is therefore necessary to resurrect the name *D. tripunctata* given by the same author in 1801.

Hence *D. vittata* becomes *D. melanocephala* (Fabr., 1775), and *D. melanocephala* (Fabr., 1798) becomes *D. tripunctata* (Fabr., 1801).

(B) Jacoby (3) has given the name *illigeri* to a species of 2-banded *Œdionychis* taken by Champion in Panama. Nineteen years later Jacoby, in error, gave the same specific name to another *Œdionychis*—this time from Trinidad (4)—which had three pale bands.

It is therefore necessary to discard the homonym of this latter insect, so the author suggests *O. abercrombyi* after the general who added Trinidad to the Empire.

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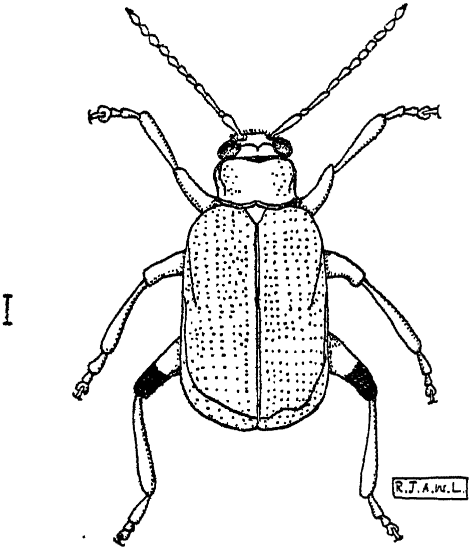
The author wishes to express his thanks to Messrs. G. E. Bryant and K. G. Blair of the Entomological Department of the British Museum (Natural History) for their help throughout the compilation of these notes.

Fig. 1.



Diabrotica rubrimarginata, sp. n. × 12.

Diabrotica rubrimarginata, sp. n. (Fig. 1.)

Elongate, a little more than twice as long as broad, black with the prothorax and the lateral and posterior margins of the elytra scarlet. Head, legs, and antennæ pale.

Length 5 mm.

Head fuscous, finely granulate; eyes prominent, black; antennæ about three-fourths length of body, flavous, first segment nearly as long as second and third together, second very small, fourth and fifth about the length of third, sixth and seventh slightly

Fig. 2.

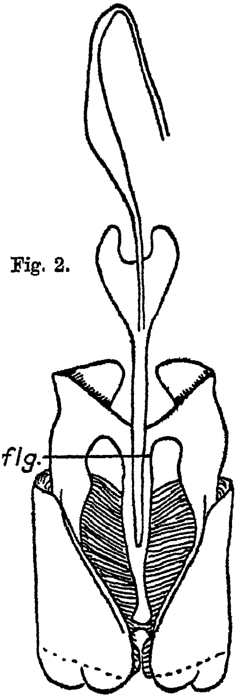


Fig. 3.

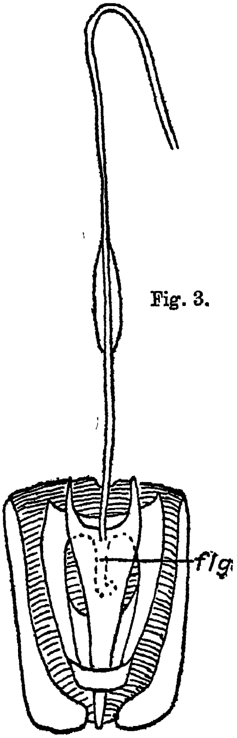


Fig. 4.

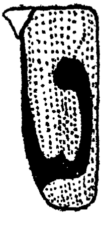


Fig. 5.

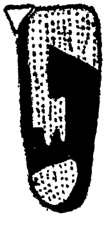


Fig. 2.—Ædeagus of *Dachrys trinidadensis*, sp. n.
Fig. 3.—Ditto of *D. tibialis*, Lac.
Fig. 4.—Right elytron of *Dachrys trinidadensis*, sp. n. × 6.
Fig. 5.—Ditto of *D. tibialis*, Lac. × 6.

flg.=flagellum.

less than fourth and fifth, the eighth to the eleventh (apical) submoniliform; prothorax subquadrate, more than twice as broad as long, slightly convex towards the head, laterally sinuate, slightly concave posteriorly, posterior angles pronounced, sloping inwards towards the elytra; scutellum black, impunctate; elytra punctate-striate, strongly convex, depressed posteriorly, widest at two-thirds of the distance from the thorax, anterior angles rounded; legs fulvous, trochanter and femur flavous, proximal portion of hind femur black, claws and last tarsal segment of all legs fuscous, first tarsal segment of hind leg as long as the following segments together; underside black with posterior margin of abdominal segments fulvous with scattered flavous pubescence.

On *Crotalaria juncea* (sunn hemp) and *Canavalia* at St. Augustine, Trinidad, B.W.I., 1930.

Type and paratype presented to the British Museum (Nat. Hist.). Described from two specimens only.

Perhaps closely allied to *D. distinguenda*, Jac., 1887, from Mexico, which is much more flavous and has additional markings on the prothorax.

Dachrys trinidadensis, sp. n.

An undescribed Clytrinid, differing in the following particulars from *Dachrys tibialis*, Lac., 1848, was taken in Trinidad in Nov. 1929:—

D. trinidadensis.	*D. tibialis.*
Same parts fulvous.	Head, antennæ, ventral surface of thorax and abdomen, and legs black.
Cubital vein fulvous.	Cubital vein fuscous.
Mandibles longer than eyes.	Mandibles shorter than eyes.
Head and pronotum finely punctate.	Head and pronotum coarsely punctate.
Area ends before the margin, which is therefore continuation of flavous ground-colour (see fig. 4).	Black area on elytra extends to external margin (see fig. 5).
Flagellum long (see fig. 2).	Flagellum of male genital armature short (see fig. 3).

The real criterion is, of course, the ædeagus, which is markedly different from that of *D. tibialis*, figs. 4 and 5 showing this better than any description.

It is of interest to note that Lacordaire (Mém. Soc. Roy. de Sci. Liège, vol. 2, v., 1848), in describing this species, refers to the legs as "rufescent pâle," while the specimens examined in the British Museum are, as shown above, black.

This beetle was usually found on the terminal buds of the sunn hemp (*Crotalaria juncea*), which it damaged. Less often it was taken on *C. usaramoensis* and the Bengal bean (*Stizolobium aterrimum*).

Type and paratypes now in the National Collection.

LXXIV.—Filaria macrophallos, *Parona, and the Genus* Hastospiculum, *Skrjabin* [*Nematoda*]. By H. A. BAYLIS, M.A., D.Sc.

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PARONA (1889) described *Filaria macrophallos* from "among the abdominal muscles" of *Varanus* [*Hydrosaurus*] *salvator* in Burma. His material consisted of a single male. Baylis and Daubney (1922) referred to Parona's species a number of female specimens from *Varanus salvator*, *V. flavescens*, *V. nebulosus*, and other Indian monitors. They also described a single male, which did not appear to agree with Parona's description, under the name of *Filaria varani*. The host of this worm was *Varanus flavescens*.

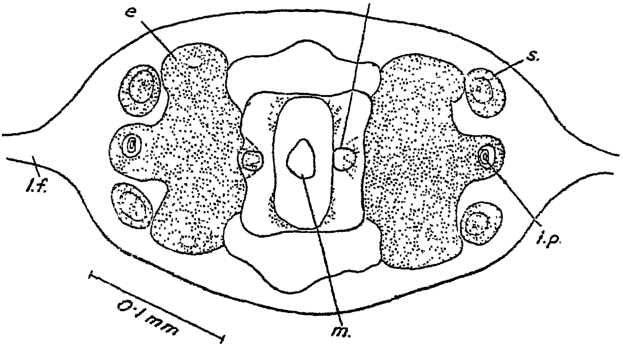
Skrjabin (1923) erected the genus *Hastospiculum* for a species, *H. varani*, Skrjabin, found in the peritoneum of *Varanus griseus* from Russian Turkestan. His material consisted of males only. Yorke and Maplestone (1926) ascribed another form to Skrjabin's genus, under the name of *H. gouldi*, from *Varanus gouldii*, a monitor which occurs only in Australasia. More recently Chandler (1929) has described a species, which he names *Hastospiculum spinigerum*, from the peritoneum of *Varanus flavescens* in India. Another Filariid from a monitor is *Filaria bipinnata*, v. Linstow (1899), found in the external covering of the stomach of *Varanus griseus* in North-East Africa. The *Filaria* sp., from the pleuroperitoneal cavity of *Varanus varius* in Queensland, recorded by Irwin-Smith (1922), may perhaps have been *H. gouldi*.

A comparison of the various descriptions mentioned above, and of such material as is available in the British Museum (Natural History), suggests that all these forms are congeneric, and that in all probability some, at least, of the described species may be identical. Unfortunately, complete specimens of *Hastospiculum* are difficult to obtain, owing to the position in which the worms occur in their hosts. The existing descriptions are also difficult to compare, on account of their incompleteness, and because in several cases only one sex has been described.

The writer has re-examined some of the female specimens recorded by Baylis and Daubney (1922) from *Varanus nebulosus*, and also a male from *Varanus niloticus* from Egypt. Both agree sufficiently closely with Parona's description (as far as this goes) and with that of Chandler (1929) of *H. spinigerum* to make it appear extremely probable that all the specimens in question belonged to the same species. It seems not unreasonable to assume that Parona, in describing the shorter spicule of the male as measuring 0·051 mm., has placed the decimal point one place too far to the left, and that it should read 0·51 mm. Chandler describes the shorter spicule as being that of the left side, and gives its length as 0·42 mm. In the male from *Varanus niloticus* the right spicule is the shorter (as is usual in Filariidæ), and measures about 0·44 mm. in length. The other spicule measures a little over 2 mm. in the present specimen, while Parona gives 2 mm. and Chandler 2·75 mm.

Chandler has drawn attention to the fact that in his material "the chitinous epaulette-like structures and circumoral papillæ described for the other species of the genus [i. e., *H. varani*, Skrjabin, and *H. gouldi*, Yorke & Maplestone] are very rudimentary if present at all." The writer has paid special attention to these structures, and has found that appearances somewhat similar to those figured by Skrjabin can be made out in specimens suitably prepared, but in specimens cleared in creosote the "epaulette-like structures" become so transparent as to be very difficult to see. In glycerine or glycerine-jelly they appear as subcuticular plates of a substance which is probably of a parenchymatous nature, certainly not chitinous, and different altogether from the framework immediately surrounding the mouth, which is clearly of cuticular origin.

Fig. 1.



Hastospiculum macrophallos, female, from *Varanus nebulosus*; mouth and surrounding structures, viewed *en face*.

e., "epaulette-like structure"; *l.f.*, lateral field; *l.p.*, lateral papilla; *m.*, mouth; *s.*, submedian papilla; *t.*, "tooth."

In Skrjabin's figure the entire apparatus is shown as if of a heavy and solid nature. If fig. 1 be compared with Skrjabin's figure, it will be found that all the essential parts of the apparatus are present, though the two interpretations of them are somewhat different. In the present figure the contrast between the stippled areas (representing the "epaulettes" and submedian papillæ) and the adjacent structures and surrounding tissues has been purposely exaggerated. The outlines of the whole system are, in reality, very delicate and not at all easily made out under a moderately high power of the microscope ($\frac{1}{6}$-in. objective).

The mouth is a relatively small aperture in the middle of a roughly oblong depression. The longer axis of this depression runs dorso-ventrally. Its lateral borders are formed by somewhat thickened plates of cuticular material, and from the middle of each of these springs a small but prominent, forwardly-directed, tooth-like process, seen in optical section in the figure. In profile, as seen in a lateral view, this "tooth" is somewhat square-ended. Below each tooth there is an appearance as of three finger-like processes converging towards the base of the tooth. These may possibly be the attachments of special muscles *. Dorsally and ventrally to the mouth-depression there are delicate, flat, cuticular plates. The outer edge of each "epaulette" is produced, at the beginning of the lateral field of the body, into a process on which is situated a lateral "papilla." This has rather the appearance of a pore than of a papilla. Dorsally and ventrally to it are the very inconspicuous subdorsal and subventral papillæ. These have very minute terminations, and it seems doubtful whether they are actually connected with the "epaulettes" in the manner shown by Skrjabin. The four other papillæ figured by Skrjabin for *H. varani*, and by Yorke and Maplestone for *H. gouldi*, do not appear to be present. There is a faint indication of a structure of some kind, suggesting a papilla, near each submedian corner of the "epaulettes," but this does not appear to be superficial, and it seems possible that it may be the point of attachment of a muscle or some other subcuticular structure.

There is considerable disagreement in the existing descriptions regarding the number and arrangement of the caudal papillæ of the male. Parona, for *Filaria macrophallos*, describes and figures four pairs of large lateral papillæ, with long peduncles, and three pairs of much smaller subventral papillæ (seven pairs in all). Skrjabin, for *Hastospiculum varani*, states that there are six pairs of preanal papillæ (two of which are "paranal"). These are arranged in a semicircle, the centre of which is in front of the cloaca. There are also two pairs of postanal papillæ. Thus, according to Skrjabin, there are eight pairs altogether. Yorke and Maplestone, for *H. gouldi*, figure five pairs of preanal papillæ (the anterior three of which are large and lateral, the two posterior smaller and subventral) and three pairs of postanal (eight pairs in all). Chandler, for *H. spinigerum*, says that the preanal papillæ are asymmetrical, there being on the right side three lateral papillæ anteriorly, followed by three more ventrally placed, the last of which is very short, and then another long lateral papilla. On the left side only three preanal papillæ could be seen, while at the posterior extremity there were three short papillæ. Thus, Chandler found altogether thirteen papillæ. For *Filaria bipinnata*, v. Linstow describes four pairs of preanal and two pairs of postanal papillæ, all of which are figured as sessile.

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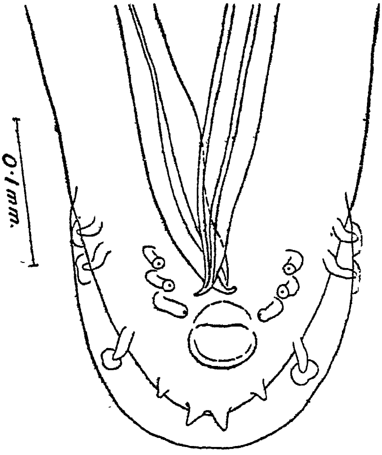
* Skrjabin describes a group of *four* indistinct papilla-like processes close to the base of each tooth. His figure, however, shows three. The middle process of each group, in his figure, is divided by a faint line, which may possibly indicate what he took for a fourth process.

Fig. 2.



Hastospiculum macrophallos, male, from *Varanus niloticus*; posterior end, ventral view.

In the male from *Varanus niloticus* already referred to (fig. 2), there are five pairs of preanal papillæ, the anterior two of which are lateral and the rest subventral. Then follows a pair of lateral papillæ at the level of the cloacal opening, and towards the posterior extremity there are two pairs of short papillæ. Thus, in the total number of papillæ (eight pairs) the present specimen agrees with those of Skrjabin and Yorke and Maplestone, while it is not very difficult to reconcile with the obviously diagrammatic figure of Parona, if it be supposed that this author missed one of the small pairs of papillæ near the posterior extremity. This may well have been hidden by the spicules, which are shown as protruded. Chandler's specimen was, perhaps, abnormal or damaged on one side. On the side which is considered the right the arrangement is very similar to that now described, except for the presence of an extra papilla at the anterior end of the series and the absence of a postanal papilla, which may have been hidden by the protruded spicule shown in the figure. In this connection it is interesting to compare the specimen figured by Baylis and Daubney as *Filaria varani*. In this the arrangement of the papillæ agrees with that now described, except for the absence of one of the three pairs of subventral preanal papillæ. The specimen was exceptional in possessing only one spicule, 0·6 mm. long, and it is difficult to determine whether it should be regarded as an abnormal individual or as representing a distinct species.

The eggs, of the Indian forms at least, are very characteristic when fully formed. They have been figured by Baylis and Daubney (1922, fig. 51) for *Filaria macrophallos* and by Chandler (1929, pl. ii. fig. 10 *a*) for *Hastospiculum spinigerum*. They have thick shells, with an annular thickening near each pole, giving them a shape somewhat resembling that of a barrel. The form of the eggs of *H. varani*, *H. gouldi*, and *Filaria bipinnata* has unfortunately not been described.

CONCLUSIONS.

From the admittedly imperfect evidence at present available, it seems possible to arrive at the following conclusions:—

(1) That *Filaria macrophallos*, Parona, 1889, belongs to the genus *Hastospiculum*, Skrjabin, 1923, and should be called *Hastospiculum macrophallos* (Parona).

(2) That *Hastospiculum spinigerum*, Chandler, 1929, is probably a synonym of *H. macrophallos*.

(3) That, so far as can be judged from their descriptions, *H. varani*, Skrjabin, 1923, and *H. gouldi*, Yorke & Maplestone, 1926, are species distinct from *H. macrophallos*.

(4) That *Filaria bipinnata*, v. Linstow, 1899, is probably to be included in the genus as a *species inquirenda*. The same applies to *Filaria varani*, Baylis & Daubney, 1922, but

this may have been merely an abnormal specimen of *H. macrophallos*. In the event of this species being shown to be valid, and definitely a member of the genus *Hastospiculum*, a change would be necessitated in the name of the genotype.

The writer wishes to express his best thanks to Dr. B. P. Uvarov for his valuable help in translating Skrjabin's description of *Hastospiculum varani*.

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LXXV.—*A new Species of Trematode from an Indian Tortoise.* By M. A. MOGHE, M.A., M.Sc., F.Z.S.

(From the Department of Zoology, College of Science,
Nagpur, C.P., India.)

THIRTY mature specimens of a trematode parasite were obtained from the digestive tract of *Emyda granosa*. Two specimens of the host were kept in a laboratory aquarium for over six months, and were fed from time to time on snails (*Pila globosa*) and on fresh-water mussels (*Lamellidens marginalis*). One of the tortoises harboured these parasites mostly in the anterior part of the digestive tract. Few were found in the small intestine and none at all in the rectum.

The worms are elliptic in shape, with more or less a uniform width, slightly narrower anteriorly and bluntly rounded posteriorly. They measure from 1·87 to 2·15 mm. in length and 0·6 to 0·73 mm. in maximum width, which is at the level of the anterior testis. The cuticle of the body is covered with small spines directed posteriorly. These are more numerous on the anterior and altogether absent on the extreme posterior end.

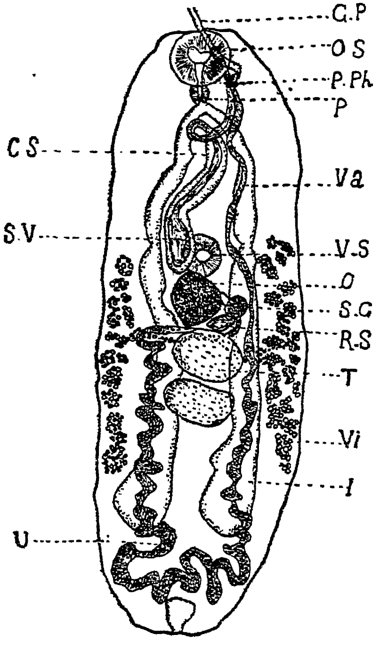
The oral sucker (*O.S.*) is terminal, and measures 0·168 mm. in diameter. It contains a small prepharynx (*P.Ph.*), and is followed by a pharynx (*P.*), which measures 92 μ diameter. An œsophagus is absent, the intestine bifurcating immediately at the base of the pharynx. The intestinal cæca (*I.*) are long, and reach to a point about 0·3 mm. from the posterior end.

The entire disposition of the ventral sucker (*V.S.*), in most of my specimens, is difficult to see, as it is partly obscured by the ovary and partly by the base of the cirrus-sac. The ventral sucker lies in the anterior fourth of the body by the side of the cirrus-sac and anterior to the ovary. It measures 0·137 mm. in diameter and, therefore, is smaller than the oral sucker.

The ovary (*O.*) is roughly a rounded body, and lies immediately posterior to the ventral sucker and slightly anterior to the middle point of the body. It measures 138 μ in diameter. It gives out a short but stout oviduct on its left side, which enters the shell-gland (*S.G.*), which is a conspicuous structure smaller than the ovary and lying to its left. The receptaculum seminis (*R.S.*) is rounded, and lies between the ovary and the anterior testis. The uterus (*U.*) commences from the shell-gland and passes by the side of the ovary, and descends in numerous coils between the ovary and the testes, and then between the testes and the posterior end of the body. The ascending portion of the uterus passes by the side of the testes, shell-gland, and the vaginal canal (*Va.*), runs in close proximity to the cirrus-sac, and opens to the exterior by the genital aperture.

The anterior of the two testes (*T.*) is a transversely elongated body posterior to the ovary and shell-gland. It measures 146 to 198 μ by 200 to 225 μ. The two testes lie one behind the other in the median line. The posterior testis is also a transversely elongated body and measures 123 to 156 μ by 190 to 230 μ. The vas deferens could not be seen, but entering the cirrus-sac (*C.S.*) is a large vesicula seminalis (*S.V.*). The cirrus-sac is large, and lies obliquely between the intestinal cæca; it extends from the anterior margin of the ovary to the intestinal bifurcation, where it coils once on itself, and then narrows and opens along with the vaginal canal on a papilla (*G.P.*) at the anterior dorsal extremity of the worm. The posttesticular space is 0·618 to 0·864 mm., according to the size and degree of maturity of the worm.

The vitellaria (*Vi.*) consist of approximately 20 to 25 vesicular groups on either side. They commence at the level of the ventral sucker, and extend to a point midway between the testes and the end of the intestinal cæca. The extent of the vitellarian group on the left side is slightly longer than that on the right. The transverse vitelline duct lies at the level of the anterior testis.



Cephalogonimus emydalis, sp. n., ventral view.

C.S., cirrus-sac; *G.P.*, genital papilla; *I.*, intestine; *O.*, ovary; *O.S.*, oral sucker; *P.*, pharynx; *P.Ph.*, prepharynx; *R.S.*, receptaculum seminis; *S.G.*, shell-gland; *S.V.*, vesicula seminalis; *T.*, testes; *U.*, uterus; *Va.*, vagina; *Vi.*, vitellaria; *V.S.*, ventral sucker.

The eggs in the uterus (in balsam) measure 27 by 11 μ.

The genus *Cephalogonimus* was erected by Poirier (1886), with *C. lenoiri* from an African turtle as the type-species. Since then eight more species have been included in this genus. One of these, *C. trachysauri*, MacCallum, 1921, is excluded from this genus by Chandler (1923), and *C. retusus*, Dujardin, has been held to be synonymous with *C. europæus*, Blaizot, 1910. The species described in the present paper differs from the other species so far described, and I propose for it the name *C. emydalis*. The genus is recorded for the first time from India. The following key gives the specific differences of this new species.

Key to the Species of Cephalogonimus.

1	(6). Testes in a line, one behind the other ..	2.
2	(5). Œsophagus present..................	3.
3	(4). Oral sucker larger than ventral; length 4·4 to 5·3 mm.; width 1·22 to 1·3 mm.; diam. of oral sucker 0·42 to 0·43 mm.; diam. of ventral sucker 0·368 to 0·38 mm.; anterior testis 0·41 to 0·48 mm. in diam.; posterior testis 0·39 to 0·47 mm. in diam.; eggs 26 μ by 13 μ. Host *Amphiuma means* ..	*amphiumæ*, Chandler, 1923.
4	(3). Oral sucker smaller than ventral; length 3 mm.; width 1 mm.; diam. of oral sucker 0·24 mm.; diam. of ventral sucker 0·29 mm.; eggs 35 μ by 17 μ. Host *Tetrathyrea vaillanti*..........	*lenoiri*, Poirier, 1886.
5	(2). Œsophagus absent; length 1·87 to 2·15 mm.; maximum width 0·6 to 0·73 mm.; diam. of oral sucker 0·168 mm.; diam. of ventral sucker 0·137 mm.; eggs 27 μ by 11 μ. Host *Emyda granosa*	*emydalis*, sp. n.
6	(1). Testes oblique	7.
7	(10) (11). Anterior sucker larger than ventral.	8.
8	(9). Length of intestinal cæca 0·85 mm.; diam. of oral sucker 0·30 mm.; diam. of ventral sucker 0·20 mm.; eggs 39 μ by 22 μ. Host *Rana esculenta*	*europæus*, Blaizot, 1910.
9	(8). Length of intestinal cæca 1·5 mm.; length 2·89 mm.; maximum width 0·83 to 0·87 mm.; size of oral sucker 0·26 by 0·24 mm.; size of ventral sucker 0·21 by 0·23 mm.: eggs 52 μ by 16 μ. Hosts *Rana virescens* and *R. clamitans*	*americanus*, Stafford, 1902.
10	(7) (11). Anterior sucker smaller than ventral; length 1·5 to 2 mm.; width 0·8 to 1·0 mm.; eggs 38 to 40 μ by 17 to 21 μ. Hosts *Aspidonectes* and *Amyda*..........................	*vesicaudus*, Nickerson, 1912.
11	(7) (10). Both suckers of the same size; length 0·69 mm.; width 0·35 mm.; diam. of suckers 0·09 mm.; eggs 30 to 34 μ by 20 to 23 μ. Host *Pseudomys floridana*	*compactus*, Stunkard, 1924.

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LXXVI.—*Two new Snakes from Tonkin, Indo-China.*

By MALCOLM A. SMITH, M.R.C.S., L.R.C.P.

THE British Museum (Natural History) is indebted to Monsieur J. Delacour for a small collection of reptiles, made by himself and Mr. Willoughby Lowe during their visit to the Fan-si-pan mountains at the end of 1929. Their chief stay was made at Chapa, a hill-station at 5000 feet altitude, to the south-west of Lao-Kay, on the Tonkin–Yunnan border (lat. 22° 5′ N.), but collecting was done upon the whole of the Fan-si-pan range, the highest peak of which reaches 11,000 feet, and is one of the highest mountains in Indo-China. A map of this area, together with a further account of the country visited, will be found in 'Ibis,' (12) vi. 1930, p. 565. The collection includes the following species, two of which are new to science:—

Ophisaurus harti, Boulenger.
Sibynophis grahami (Boulenger).
Elaphe mandarina (Cantor).
Natrix subminiata helleri (Schmidt).
Trirhinopholis nuchalis, Boulenger.
Pareas hamptoni (Boulenger).
Trimeresurus monticola, Günther.

Coluber delacouri, sp. n.

Type, adult male. Maxillary teeth 23. Snout obtuse, scarcely projecting; eye moderate, half as long as the snout. Rostral as broad as high; internasals two-thirds the length of the prefrontals; frontal considerably longer than broad, longer than its distance from the end of the snout, shorter than the parietals; loreal small, longer than broad; preocular just visible from above, not touching the frontal; two postoculars; temporals 2+2, the upper anterior one very small; eight supralabials, the fourth and fifth touching the eye; six infralabials, four in contact with the anterior sublinguals which are as long as the posterior; both pairs of sublinguals in contact with one another.

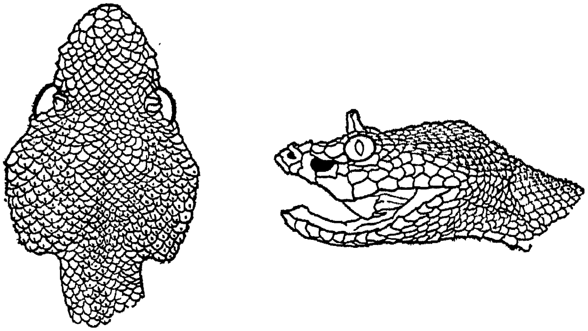
Scales in 15.15.15 rows, the median five or seven rows distinctly keeled, except quite anteriorly. Ventrals rounded, 169 anal divided; subcaudals 79 pairs.

Uniform blue in alcohol, presumably green in life, above, paler below.

Total length 1210; tail 275 mm.

The paratype, a female, also from the Fan-si-pan range, differs from the above in the following particulars:—A single anterior temporal; dorsal scales quite smooth; ventrals 170; subcaudals 83 pairs.

Coluber delacouri is most nearly related to *C. moi* (Smith) from Annam and Tonkin. It differs in the lower subcaudal count (*C. moi*, 96 to 103), and very distinctly in coloration.



Trimeresurus cornutus, sp. n. × 1½.

Trimeresurus cornutus, sp. n.

Type, a male, probably not full grown. Snout twice as long as the diameter of the eye, which is as long as its distance from the mouth. Rostral broader than high; upper head-scales small, smooth upon the crown, keeled posteriorly, eleven in a transverse series between the supraoculars, which are broken up into three or four scales; these are strongly erect and together form a horn-like appendage; internasals slightly raised at their outer margins, separated from one another by two or three scales. Nine supralabials, the second forming the anterior border of the loreal pit, the third the largest, the fourth immediately below the eye, and separated from it by three rows of small scales, the upper one of which (subocular) is elongate; three or four postoculars; temporals small, keeled; thirteen or fourteen infralabials; a single pair of elongated sublinguals.

Scales in 21.21.17 rows, keeled; ventrals 193; anal single; subcaudals 68 pairs, tail, not quite complete, slightly prehensile.

Greyish brown above, with two more or less distinct dorsal series of squarish darker spots, edged with blackish, which usually meet on the vertebral line and form cross-bars; occasionally they alternate; a lateral series of whitish spots. Below whitish, thickly powdered with brown. Head with small, irregular, brown spots.

Total length 587; tail 107 mm.

No horned species of *Trimeresurus* has yet been recorded from the Old World, although two are known from Central America, namely *T. schlegeli* and *T. undulatus*[*]. The condition is foreshadowed in the Malayan *T. puniceus*, in which the supraoculars are broken up and pointed, but are not erect. *T. cornutus* differs also from *T. puniceus* in having more ventrals and more subcaudals, but in other respects it appears to be its nearest ally.

LXXVII.—*Note on an unusually large Specimen of the Vaagmaer* (Trachypterus arcticus, *Brünn.*). By COLIN MATHESON, M.A., B.Sc., Keeper of Zoology, National Museum of Wales.

WHAT appears to be the largest specimen of the rather rare Vaagmaer or Deal-fish (*Trachypterus arcticus*, Brünn.) ever recorded in this country has just been presented to the Department of Zoology, National Museum of Wales, by Mr. Morley H. Neale, of the Cardiff trawling firm of Neale and West, Ltd. Although somewhat damaged it is in sufficiently good condition to permit of the more important measurements being taken. The fish has a total length of 8 feet 3 inches; the greatest height of the body is 1 foot 8¾ inches (excluding the damaged dorsal fin), and the greatest thickness from side to side (about 16 inches from the hind margin of the orbit) is 3 inches; the eye is 3 inches in diameter. These measurements are considerably in excess of those of the largest British specimen previously recorded—namely, 7 feet 9 inches long, 1 foot 3¼ inches greatest depth, 2½ inches greatest thickness. Day[†] refers to this fish (washed ashore on the Irish coast) as the longest British example known, but adds "the fish is said to attain to several feet more." Most of the British specimens recorded have been considerably smaller than the above, ranging only from 3 to 6 feet in length.

The present fish is, so far as the writer can ascertain, the largest example of the species so far recorded anywhere, slightly exceeding the maximum length (246 cm.) stated to have been observed by Collett among Norwegian specimens[‡]. The occurrence alleged by fishermen of Deal-fish 3 metres in length has not apparently been substantiated up to the present.

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[*] Until some character can be found to distinguish the Old from the New World species, I prefer to retain them all under one genus.

[†] Day, 'The Fishes of Great Britain and Ireland,' vol. i. p. 219.

[‡] Fries, Ekström, and Sundevall, 'A History of Scandinavian Fishes,' Part I. p. 316.

The habitat of the species is stated to be the North Atlantic, from Iceland to the shores of the British Isles, in waters from 200 to 300 fathoms deep. Specimens are occasionally washed ashore in Norway, Sweden, and Denmark. It may be noted that, with one exception, all the British records given by Day * and by Travis Jenkins † are from the east coast and from the Orkneys and Shetlands. The exception is the large Irish specimen alluded to above, which was washed ashore at Bundoran, on the southern shore of Donegal Bay, in 1875 ‡. The present fish is also from off the western Irish coast, having been brought up in the trawl from a depth of 230 fathoms, just south of the well-known Porcupine Bank, in latitude 52° 20′, longitude 14° 20′, on the 3rd of October, 1930.

Both eyes were measured, as it was thought that one might prove to be larger than the other, but in each case the diameter is exactly 3 inches; and, so far as one can judge from the rather rubbed condition of the sides, there is no appreciable difference in appearance between the right and the left side. Lütken § found that the eyes were of different sizes in four out of the ten specimens which he measured in this respect; and in certain examples the sides are said to differ from one another. It is suggested that the fish may habitually or frequently swim on one side like a Pleuronectid, and eye-witnesses say that this is the case (though a specimen near enough to the surface to be observed by man is presumably in unnatural surroundings and very probably diseased).

There do not appear to be any vestiges of pelvic fins in the present example. This is in accordance with the description and the figure given by Day, but it should be noticed that Günther describes *Trachypterus* as a genus "in which the ventral rays are well developed, and composed of several more or less branched rays" ‖, and that Boulenger says "ventral fins more or less developed, with 6 to 9 rays, or reduced to a single long ray" ¶. Fries, Ekström, and Sundevall state that the ventrals in this species are usually absent, though they generally leave traces, at least in specimens not more than one metre in length, in the form of a row of stumps, up to ten in number, just behind the perpendicular from the end of the horizontal base of the pectoral fin.

The distance from the tip of the snout to the vent is 4 feet 3 inches—that is, over 53 per cent. of the body excluding the caudal fin. This, in view of the fact that the specimen is one of the largest known, is a slightly higher proportion than suggested by Lütken*, who says that with increasing age the proportion sinks, on an average, to 51 per cent., or even as low as 49 per cent.

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* Day, *loc. cit.*

† J. Travis Jenkins, 'The Fishes of the British Isles, both Fresh Water and Salt,' p. 119.

‡ 'The Zoologist,' 1875, p. 4343.

§ As quoted by Fries, Ekström, and Sundevall, *loc. cit.*

‖ Günther, 'The Study of Fishes,' p. 522.

¶ 'Cambridge Natural History,' vol. vii. p. 715.

In young specimens, it is stated, the greatest depth of the body may be no more than 15 or 16 per cent. of the total length; but it increases subsequently to at least 20 per cent., or as much as 21·4 per cent. The proportion of depth to length (excluding the caudal fin) in the case of the present specimen is 21·8 per cent.

It seems proper to put this example on record on account of its unusual size and the exact particulars, as to place and date of capture, accompanying it.

LXXVIII.—*On new Species of* Latiaxis, Fasciolaria, Cassis, *and* Sunetta. By Hugh C. Fulton.

[Plate XVIII.]

Latiaxis kinoshitai, sp. n. (Pl. XVIII. figs, 1, 1 *a*.)

Shell, form as figured; colour creamy-white; allied to *L. deburghiæ* and *L. purpuratus*, but has a longer spire, thicker and less numerous spiral cords than either of those species.

Maj. diam. (including spines) 29 mm.; alt. 36 mm.

Hab. Kii, Japan.

Fasciolaria strebeli, sp. n. (Pl. XVIII. figs. 2, 2 *a*.)

Shell, form as figured; colour, nucleus (1½ whorls) whitish, other whorls medium reddish brown, partly covered by a darker brown periostracum; interior and columella cream-white; whorls, 6½ strongly noduled; on the upper whorls can be seen (under the lens) numerous very faint spiral cords, on the last whorl these cords are so little raised that to the naked eye they appear to be coloured lines on a flat surface; peristome rather thin, serrated at margin and edged with brown colour. The channel at junction of upper part of columella and peristome is rather deep, with a very strong entering plait at left side of channel; there are two not very conspicuous spiral plaits at lower part of columella.

Maj. diam. 29 mm.; alt. 69 mm.

Hab. Deep water off Natal, South Africa.

This has been recorded as *F. heynemanni*, Dunker, but that species is much broader in form, and is readily separated by its prominent thick spiral cords, whereas *strebeli* is practically smooth. The species is named in honour of the late Hermann Strebel, the author, amongst other works, of an excellent illustrated Monograph of Fasciolaria in 'Mitteilungen aus dem Naturhistorischen Museum,' Hamburg, 1911.

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* As quoted by Fries, Ekström, and Sundevall, *loc. cit.*

Cassis africana, sp. n. (Pl. XVIII. fig. 3.)

Shell, form as figured, of a light reddish-brown colour with some distant, but distinct darker spots situated just below the suture of the lower part, on the last half-whorl are faint indications of three spiral rows of squarish spots; whorls 7, first three smooth, whitish, the remaining four have numerous spiral cords (about 14 on the penultimate whorl), last half-whorl somewhat granulated; columella white, smooth at lower part, upper part faintly showing the spirals, about 4 mm. interiorly the columella projects outwards and bears six plaits, the upper one very small, the others larger; the interior of the outer lip has a few rather distant and short teeth situated well below the margin, the lip is much thickened, and has at its rear a raised margin about 3 mm. wide; anterior canal deflected backwards; posterior canal with a strong entering nodule or cord.

Max. diam. 27 mm.; alt. 42 mm.

Hab. Off Natal, South Africa.

I have not found any other species of *Cassis* with a similar disposition of the internal plaits.

Sunetta perexcavata, sp. n. (Pl. XVIII. figs. 4, 4 *a.*)

Shell, form as figured, smooth and polished surface, exterior coloration very light reddish-brown tint, covered with more or less distinct zigzag markings, has also some rather indistinct whitish oblique rays, one specimen is of darker coloration with numerous darker reddish-brown rays; posterior excavation very wide and deep, ornamented by transverse dark reddish lines; anterior, posterior, and ventral margins crenulated; hinge, pallial line, and sinus normal.

Width (anterior to posterior) 39 mm.; height (umbones to ventral margin) 31 mm.; max. depth or thickness 20 mm.

Hab. West Australia.

The nearest allied species known to me is *aliciæ*, Ad. & Ang., which is smaller and much more globose in proportion to its size. The external ligamental cavity of *perexcavata* is also larger and deeper.

EXPLANATION OF PLATE XVIII.

Figs. 1, 1 *a.* *Latiaxis kinoshitai*, sp. n.
Figs. 2, 2 *a.* *Fasciolaria strebeli*, sp. n.
Fig. 3. *Cassis africana*, sp. n.
Figs. 4, 4 *a.* *Sunetta perexcavata*, sp. n.

LXXIX.—*An extinct Cane-Rat* (Thryonomys logani, *sp. n.*) *from the Central Sahara.* By Alfred S. Romer and Paul H. Nesbitt, Walker Museum, The University of Chicago.

In 1925 the Logan Museum of Anthropology, Beloit College, Beloit, Wisconsin, while in the course of a trans-Saharan expedition, purchased a collection gathered by M. Louis Chapuis, of la Balme-les-grottes, France. The major partion of the material consisted of stone artifacts and exhumed human remains. Included, however, was a series of bones from the Tanezrouft region of the Central Sahara, which we shall discuss below.

The remains were obtained from the valley of the dry Oued Odiemet, a tributary of the Oued Tamanrasset, at a location about 140 km. south-west of Fort Leperrine (Tamanrasset), approximately 4° 30′ E., 22° N., about 800 km. from the Niger and 1300 km. from the nearest point on the Mediterranean coast. The various specimens were all from a small area in the valley of the stream, and below the bluffs bordering it, on the left bank below the junction with the Oued Tis a ouen, and near the automobile route from Silit to Borzikol. The material in which they were found was described as "dried mud" in the field-notes ; it is almost unconsolidated, slightly argillaceous sand, undoubtedly representing an overflow from the now dry stream. There is no evidence that the various specimens were exactly contemporaneous. The association of skeletal elements in several instances seems to put redeposition out of the question. The bones are encrusted, partly with calcium carbonate, partly with silicious material ; fresh breaks show that cavities in the bone are unfilled, and apparently there has been little or no replacement of the bone.

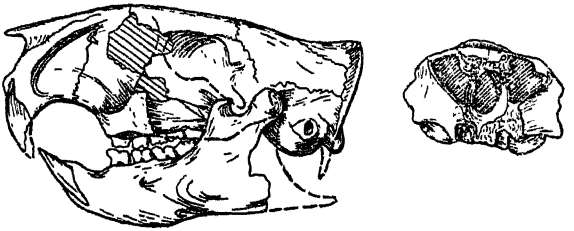
The material includes some human remains, vertebræ of an unidentified snake, teeth of a buffalo, gazelle horn-cores, unidentified bovid fragments, an ostrich metapodial, and three specimens of a rodent.

The rodent remains include the greater part of a skull and skeleton of an adult animal (no. 2202 Walker Museum), a partial skull of a second individual of the same type (no. 2303), a fragment of a palate of a young individual with m^3 just erupting (no. 2204).

The three specimens pertain to a single species, which is obviously related to the living cane-rats of Central and

Southern Africa. The present specimens agree with *Thryonomys swinderianus* and differ from the smaller types, which Thomas * has separated as the genus *Chœromys*, in that (1) the grooving of the upper incisors resembles that of the first-named form †, (2) frontal sinuses are present, as shown by a break through the skull of no. 2202, and dorsally constrict the opening from the brain-case to the olfactory fossa as in *Thryonomys* proper.

From the only material of *swinderianus* which we have at hand for comparison (a skull and skeleton from British East Africa, loaned by the U.S. National Museum) the present material differs in a number of respects: (1) although sinuses are present in the frontals, these bones are not at all inflated, but pass smoothly over the parietals; (2) sagittal and occipital crests are much less developed, the former existing as a low ridge on the interparietal only, the latter rising but a few millimetres above the general level of the brain-case; (3) the upper margin of the foramen magnum is nearly horizontal, whereas in *T. swinderianus* it is V-shaped; (4) the bullæ are considerably more expanded than in that species, extending well below the plane of the basioccipital; (5) the hard palate ends in a smoothly rounded margin (more V-shaped in *T. swinderianus*); (6) the posterior portion of the jaw is shortened, the ascending ramus rises more steeply behind the tooth-row, the mandibular notch is shorter and deeper, and the condyle closer behind the coronoid process. All these features, except the last, are seen in both specimen no. 2202 and no. 2203. The speci-



Left, side-view of type-skull of *Thryonomys logani*. Right, anterior view of the brain-case of the same specimen as seen from a break across the skull to show the relation of frontal sinuses and opening into the olfactory fossa. × ½.

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* Thomas, O., "On the Animals known as 'Ground-Hogs' or 'Cane-Rats' in Africa," Ann. & Mag. Nat. Hist. (9) ix. pp. 389–392 (1922).

† Thomas, O., "Description of a new Species of Reed-Rat (*Aulacodus*) from East Africa," Ann. & Mag. Nat. Hist. (6) xiii. pp. 202–204 (1893).

men with which comparison is made is presumably *T. swinderianus variegatus*; if other subspecies were available, it is possible that the contrast might not have been as great. In any case, however, it seems certain that the form is a distinct species, which may be designated as *Thryonomys logani*, sp. n., Walker Museum no. 2202 to be taken as the holotype, and nos. 2203 and 2204 as paratypes. The specific name is given in honour of Dr. Frank G. Logan, of Chicago, through whose generosity the African work of the Logan Museum was rendered possible.

The form is apparently extinct. From the circumstances noted above regarding the condition of the material and its place of origin, it is obvious that these specimens are not of any great age; it seems improbable that they are older than late Pleistocene, more probably early Recent (in the geological sense of that term). The presence, in the same deposits, of human remains which appear to be of "modern" type also suggests a late date; but it must be remembered that there is no proof of contemporaneity.

This find is of some interest with regard to the history of the Sahara. It is generally believed that in times past this now dry and inhospitable region was much more plentifully watered than is the case at present. For the northern borders of the region, there is historic evidence that progressive dessication has taken place *; regions which in Carthaginian and Roman days supported a large population are now almost uninhabitable. There is also considerable evidence that much of the arid portion of Algeria was much more fertile than at present in Pleistocene and post-Pleistocene times. For the more central portions of the Sahara, however, direct evidence is slight.

The region from whence the present remains are derived is now one of the more arid regions of the Sahara. "The much dreaded Tanezrouft . . . forms a tract of desert in which there is no water, no grazing and no wood. . . It does not boast even of a nomadic population" †.

The cane-rat, however, is an inhabitant of an entirely different type of country. As is well known, it is found only in well-watered regions, generally near the banks of streams, living in dense thickets and cane-brakes. It is impossible that it should have existed in the Central

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* Gsell, 'Histoire Ancienne de l'Afrique du Nord,' vol i. pp. 40-100 (Paris, 1913).

† Haywood, A. H. W., 'Through Timbuctoo and across the Great Sahara,' pp. 294, 297 (London, 1912).

Sahara under conditions anything similar to those present to-day. Its presence in the Tanezrouft is strong evidence that in geologically recent times the Sahara was a well-watered region locally capable of supporting an abundant vegetation.

LXXX.—*New Fijian* Geometridæ.

By LOUIS B. PROUT.

SINCE I published in these 'Annals' (ser. 10, vol. iii. pp. 595-597) three new forms of Geometridæ discovered by Mr. H. Phillips, the Imperial Institute of Entomology has received further and still more interesting consignments, chiefly from the same source, including several species new to science. I take the opportunity to add one, of which the type is in the Zoological Museum of Hamburg. The zoo-geographical importance of the present list is that no less than half the species add to the known range of well-defined genera. Three of these genera—*Luxiaria*, *Bulonga*, and *Petelia*—belong to the subfamily Geometrinæ, which, as I have remarked elsewhere (Ins. Samoa, Brit. Mus. Nat. Hist. iii. (3) p. 152), seems to be but poorly represented in the Pacific islands.

Subfam. *STERRHINÆ.*

Erythrolophus bipunctatus idmon, subsp. n.

♂.—32 mm.

Differs from name-typical *bipunctatus*, Warr. (1899), as follows:—

Apex of fore wing slightly less sharp; tone more vinaceous, median shade strong, rather more distally placed, at least on hind wing; postmedian of fore wing rather less proximal at SC^4 and SC^5, the dot on R^1 not enlarged; cell-spot of hind wing not distinctly bipupilled.

Viti Levu: Vunidawa, 18 December, 1929 (*C. S. Phillips*), type in coll. Brit. Mus.

May well prove a separate species. *E. bipunctatus*, Warr., founded on a ♂ from Milne Bay, shows no geographical variation in New Guinea nor on Dampier Island. Warren's generic placing was quite tentative, and the structure has never been published. The palpus is rather short, with terminal joint in ♂ short, in ♀ less so. The antennal pectinations of the ♂ are very long. The hind leg of the ♂ is *Organapoda*-like, that of the ♀ has one proximal and two terminal spurs. The areole is double, ample, with the partition (base of *SC*^{4}) arising from the cell. Apparently it will demand a new genus.

Subfam. *LARENTIINÆ.*

Gymnoscelis tylocera, sp. n.

♂.—10–11 mm.

Face with small pointed dark cone below. Palpus about 1½, first and second joints with projecting scales, dark-spotted on outer side. Antenna above with a small protuberance near base, recalling that of the fore tibia of *minutissima*, Swinh. (1904), though less large; raised scaling at ends of joints pronounced; ciliation dense, rather less than 1. Abdomen relatively robust. Head and body concolorous with wings.

Fore wing moderately broad, costa arched distally, apex not acute; *SC*^{1} running into *C*; very light greyish olive, costal edge narrowly light brown; lines brownish, becoming strong (black-mixed) at costa; subbasal slight, except at costa; antemedian strongly sinuous, with the inward curves at *SC* and *M*; postmedian not greatly beyond cell, strong in places, thickened at costa, deeply inbent between the radials; subterminal not very conspicuous, deeply, but not quite regularly crenulate, defined proximally by blackish spot at costa, and browner ones between the radials and near tornus; distal area very slightly darker grey-olive; terminal line not intense, interrupted at the veins; fringe light brownish.

Hind wing with termen slightly sinuous, rather prominent at *R*^{3}–*M*^{1}, very faintly concave between the radials; concolorous with fore wing; rather weakly marked, excepting the postmedian line, which, in addition to its inward bend between the radials, has a rather strong angle outward at *R*^{3}.

Fore wing beneath somewhat browner, glossy; hind wing somewhat paler; confused indications of a postmedian line, which is stronger at costa of fore wing.

Lautoka, the type 10 December, 1921, paratype 9 December, 1921 (*W. H. Greenwood*), bred from larvæ feeding on leaves of *Glochidion*. Type in coll. Brit. Mus.

Similar to *refusaria*, Walk., 1861 (=*minima*, Warr., 1897, *maculilinea*, Warr., 1898), but, apart from slight differences in shape, distinguishable by the strong bend of the postmedian and by the ♂ antenna.

Sauris acanthina, sp. n.

♂.—30 mm.

Head light green. Palpus white, with first joint narrowly black above, the rest broadly black on outer side. (Antennæ lost.) Thorax above green. Abdomen above green, with dark markings at the ends of the segments and with minute whitish crests; sides largely blackened; venter partly brown; anal tufts partly whitish, partly (at least beneath) glossy blackish. Legs more or less strongly darkened; hind leg without spurs, but long and slender, not crooked.

Fore wing with termen not excised between the medians, the fold and SM^2 curved, the tornus only slightly contorted; yellowish oil-green, with blue-grey (Payne's grey) areas at termen, at R^2, and between M^1 and fold; a black cell-dash; lines black, rather heavy, in part accompanied by some Payne's grey shading; an incomplete one close to base (obsolescent in outer half); subbasal strongly angled outward, the angle complex, vaguely tridentate; median band composed of five lines, slightly interrupted at some of the veins, the two antemedian well separate in front of SC (enclosing a grey area, which is slightly bisected by an additional line), thence almost entirely confluent, deeply lunulate-dentate; the three postmedian lunulate-dentate, the outermost rather sharply angled outward behind R^1 and more slightly behind R^3; space between postmedian and subterminal in front of the grey radial streak conspicuously clear green, on and behind the streak (to hind margin) with two or three interrupted dentate lines; termen with large vein-spots; fringe spotted.

Hind wing small and contorted, the compound vesicle at base of abdominal margin large; discocellulars apparently wanting; C not anastomosing with SC, connected by a bar proximally to middle of wing, thence running to termen close to apex, while SC^2 curves away violently to reach termen near middle; a strongly curved radial (its origin not discoverable without denudation) running to termen about midway between SC^2 and the false termen; drab-greyish, becoming much darker and more blue-grey distally; no markings; proximal part and abdominal margin with long, longitudinally-placed hair; distal with dense specialised scaling.

Fore wing beneath costally and distally deep slaty grey, behind the fold lighter, behind SM^2 whitish; central part with patches of dark hair and specialised scaling, in places with strong rose-thorn-shaped spicules. Hind wing beneath darker distally than proximally, the distal part clothed with bunches of hair, largely supported by the rose-thorn spicules, the proximal part with ridges of long hair and some androconial patches.

Lautoka, July 1929 (*H. Phillips*), type in coll. Brit. Mus.

A detailed account of the specialisations of this remarkable species would require several pages. When more material is to hand, it could be recommended to an expert microscopist for a thoroughgoing investigation.

Sauris priva, sp. n.

♂.—31 mm.

Face deep greyish olive, with a pair of subconfluent white spots above. Palpus about 2; first joint white, second olive, somewhat mixed with white; third joint relatively elongate. Antenna laterally compressed, above with an indentation at 2·5 mm. from base (one antenna and distal part of the other lost). Head and body whitish, tinged with drab; a deep greyish-olive band on crown, suggestions of others on thorax and base of abdomen. (Middle legs lost.) Hind tibia rather short, beginning to thicken before middle, culminating in a strong long-scaled club, from the end of which project some small tufts of dark hair-scales; hind tarsus moderate, about $1\frac{1}{2}$ tibia.

Fore wing with costa well arched in distal half, termen oblique, curved, becoming more strongly oblique at R^2, notched before M^2, at M^2 slightly lobed, with the extremity of the lobe directed a little forward; a small curled tuft of light brown hair beneath, in front of the end of SM^2, preceded proximally by a small concavity; white, copiously marked with deep greyish olive, which in places (especially the longitudinal markings) is mixed with black; cell-dot moderate, blackish, slightly elongate; subbasal line dark, angled outward in base of cell; median band chiefly developed at its proximal and distal ends and at costa and hind part, with an ill-defined longitudinal streak on SM^2; antemedian dentate, somewhat outbent in middle, little proximal to cell-dot; postmedian nearly as in *ignobilis*, Butl. (1880), markedly oblique outward to a strong, but blunt projection at R^2, then as oblique inward as termen, but strongly lunulate-dentate, with the longest tooth outward in cellule 3 and the deepest lunule inward at M^2; some distal cloudings, one at costa the most noticeable; the twin marks between the radials very strong, nearly confluent, elongate, reaching from lobe of postmedian to subterminal; an irregular line, in places blackish-mixed, defining the subterminal distally; terminal vein-dots strong, blackish.

Hind wing rather small; costa somewhat arched in its distal part; apex, with anterior part of termen, rounded, leading to a rather shallow concavity at SC^2, somewhat puckered in front of this; a false tornus at R^2 (R^3?); posterior part of wing mostly absorbed in a large compound proximal vesicle, roughly resembling that of *ignobilis*; cell very short; the usual subcostal bar near its end lost in a point-anastomosis with C; DC^1 very oblique; C ($=SC^2$?) rather remote from costa, fairly straight, SC^2 and R^1 (or R^1 and R^2?) arising close together, at end near anterior angle of cell, the former running to the terminal concavity (midway between C and false tornus), the latter to near false tornus; M (boundary of cell and vesicle) curving strongly after DC, to form the distal wall of the vesicle, in its most distal part giving rise to a slender vein (R^2 or R^3); dirty white tinged with drab; a pencil of long, rather more drab hair from near base in front of the vesicle, a slenderer pencil from close to base of abdominal margin.

Underside varied with light brownish drab, whitest at hind margin of fore wing and on parts of hind wing. Fore wing with dark grey cell-mark and traces of some of the principal markings, especially a postmedian patch at costa; an appreciable darkening at tornus. Hind wing with a dark terminal patch between the anterior two veins.

Vunidawa, 11 March, 1930 (*C. Phillips*), type in coll. Brit. Mus.

The unique type is unfortunately rubbed and defective, but is a strikingly distinct species. It may prove near *ignobilis*, but the palpus is considerably shorter, the shape and venation of the hind wing very different, etc.; if C of the hind wing becomes obsolete—coincident with SC^2—after the anastomosis, the venation shows some analogy to that of *nigrifrons*, Warr. (1907), which has similar colouring and maculation, but shows important differences in structure.

Subfam. *GEOMETRINÆ.*

Scardamia eucampta, sp. n.

♀.—30 mm.

Closely related to *chrysolina*, Meyr (1892). Wings more rounded, especially the termen of the hind wing; colour deeper orange; lines thicker; hind wing with antemedian line straighter, postmedian much more curved.

Lautoka, January 1929 (*H. Phillips*), type in coll. Brit. Mus.

A worn ♀ from Mahé, Loyalty Is., in coll. Tring Mus., is apparently identical, though it is possible that good material may show some racial distinction.

Bulonga phillipsi, sp. n.

♂.—45 mm.

Head light brown, nearly as in *griseosericea*, Pagenst. (1886), or rather less bright. Palpus with the projecting ridges of scales darker-mixed. Thorax and abdomen concolorous with wings; abdomen whitish at the ends of the segments.

Fore wing with apex scarcely so acute as in *griseosericea*; ground-colour about as in *schistacearia*, Walk. (1859), or slightly duller, without the strong silky gloss of *griseosericea*; costal edge pale-mixed, with rather strong dark strigulæ, which are in part traceable for a distance across the wing; cell-dot small, black; lines dark grey, much as in *griseosericea*, the postmedian rather more curved posteriorly; terminal line blackish; fringe white.

Hind wing with termen angled as in *griseosericea*; costal margin white; the rest concolorous with fore wing, the markings (except antemedian) continued, the postmedian crenulate.

Underside very distinct; white; fore wing with smoky suffusion to beyond the blackish cell-dot, and with an ample blackish border, measuring 8 or 9 mm. at apex, tapering rapidly to M^1, then more gradually to hind margin, where it measures scarcely 2 mm.; hind wing with a series of blackish subterminal spots, the apical one large, reaching SC^2 and touching the first of four interneural ones, which are otherwise well isolated, the last one elongate, running from near M^2 to abdominal margin.

Lautoka, 5 November, 1928 (*H. Phillips*), type in coll. Brit. Mus.

Luxiaria sesquilinea, sp. n.

♂.—35 mm.

Structure about as in *exclusa*, Walk. (1860), which it probably represents in Fiji. Antennal serration (subpectination) perhaps slightly less developed. Smaller than *exclusa*.

Fore wing with termen feebly sinuate close to apex; very pale buff, with some fine scattered dark irroration; a very oblique, brown, black-mixed line from just proximal to middle of hind margin to termen about SC^5, mostly straightish and firm, about R^1 slightly bent and interrupted; termen with some dark interneural dots.

Hind wing with termen somewhat crenulate, especially in front of the angle (shaped more as in *iotaria,* Feld., 1875, than in *exclusa*) ; line of fore wing continued antemedially, bent just behind base of SC^2 and crossing DC^2, then straight to abdominal margin; in addition, a postmedian, strong from abdominal margin nearly to R^1, then curving and gradually dying out; terminal dots indicated.

Underside yellower, with the irroration denser; small cell-dots indicated; lines weak; antemedian of hind wing placed as above, but continued on fore wing by a weak and vertical, not oblique one, which runs about to the cell-dot and disappears; faint traces of the oblique line of fore wing from fold forwards, also on both wings of a subterminal, which, near the abdominal margin, is developed enough to show the dentate form of that of the allies.

Viti? (*C. A. Stuhlmann*), type in Zool. Mus. Hamburg.

As all the specimens with the above labelling which have been submitted to me are indisputably Fijian, the locality, unless as to detail, need not be queried; all the less because the present species is just such an outlier of the very widely distributed *exclusa* as Fiji might be expected to produce.

Petelia aesyla, sp. n.

♂.—42 mm.

Head and body concolorous with wings. Structure of palpus, antenna, and legs typical, the antenna rather long, with the pectinations long and strong, commencing short on the first joint, then much longer, reaching their maximum development about the 10th, gradually shortening distally, ceasing at the 44th.

Fore wing with termen slightly less regular than in *medardaria,* H.-Sch. (1856), very faintly sinuous anteriorly, so that the apex appears minutely produced; coloration about as in *medardaria,* light brownish drab with the cloudings cinnamon, and with copious grey strigulæ; cell-dot small; antemedian line vague, curved, cinnamon-tinged; median firm and dark from SC^5 to hind margin, formed as in *immaculata,* Hmpsn. (1893); markings of distal area vague (probably as variable as in the allies).

Hind wing with termen shallowly excavated between SC^2 and R^3, at which are formed appreciable, though blunt teeth, the centre of the bay (between the two strong folds which it contains) straight; colour and markings as in the allies.

Underside nearest that of *immaculata,* the fore wing having the same large black cell-spot, the hind wing none; borders less broad and less intense than in that species; no other markings, except the substrigulate irroration; both wings, but especially the hind, very definitely suffused with cinnamon.

Vunidawa, 2 April, 1930 (*C. Phillips*), type in coll. Brit. Mus.

LXXXI.—*A Note on Javanese Monkeys.*

By C. Boden Kloss.

In a popular Natural History Journal published in Java ('De Tropische Natuur: orgaan van de Ned.-Indische Natuur-Historische Vereeniging,' xix. 1913, p. 68) Mr. H. J. V. Sody has proposed a new race of *Pithecus aygula* (Linn.), which may escape the notice of zoologists in Europe: therefore I give below a translation of his description:—

Pithecus aygula fredericæ, Sody.

"On Mt. Slamat, Western Mid Java, 1000 metres, I collected a pair of langurs which appear to represent a hitherto totally unknown race of the 'soerili' (*Pithecus aygula*, L.). The principal differences from the true *aygula* are the black dorsal side (grey in the typical form) and the underside also black (excepting only a white stripe on the throat and white abdomen): in *aygula* the underside is white throughout. The skull exactly matches that of the West Java race. This form has remained unrecognised until now only because it is so wonderfully like the 'loetong' (*Pithecus pyrrhus*) that the natives of the locality regard both as the same animal. It is only by obtaining an example, and particularly by examination of the skull, that the differences are made clear."

This action would apparently confine the typical animal (*P. aygula aygula*, Linn.) to West Java—the eastern third of the island.

As compared with the other large land-masses of Malaysia, the Primates are comparatively poorly represented in Java: they occur as follows:—

Hylobates moloch moloch (Audebart) *. Western Java only †.

Pithecus pyrrhus sondaicus, Robinson & Kloss. West Java ‡, ? Mid Java.

Pithecus pyrrhus pyrrhus (Horsf.). East Java §.

Pithecus aygula aygula (Linn.). West Java only.

Pithecus aygula fredericæ, Sody. Mid Java, ? East Java.

Macaca irus mordax, Thos. & Wr. Throughout Java †.

Nycticebus coucang javanicus, Geoff. West Java only †.

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* Vide *Hylobates cinereus cinereus*, Kloss, P. Z. S. 1929, p. 119; *Hylobates moloch*, Cabrera, P. Z. S. 1930, p. 257.

† *Fide* Dammerman, Treubia, xi. 1929, p. 33.

‡ Ann. & Mag. Nat. Hist. (9) iv. 1919, p. 374: Tjibodas, Preanger Regencies, West Java.

§ *Tom. cit.* p. 375: Province of Pasuruan, E. Java (R. & K. det.).

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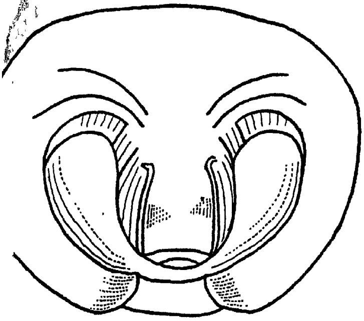

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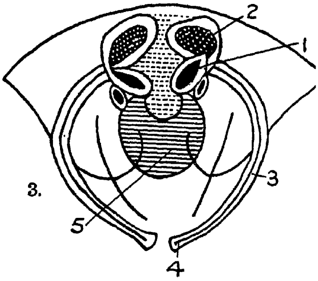

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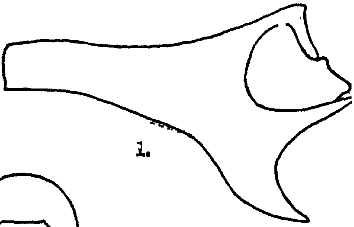

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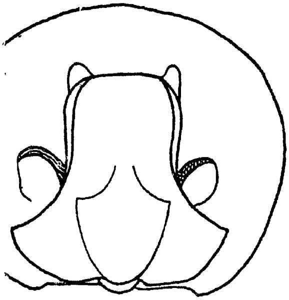

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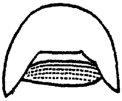

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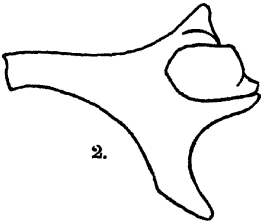

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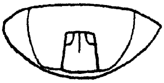

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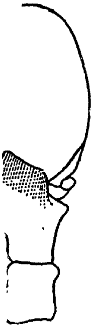

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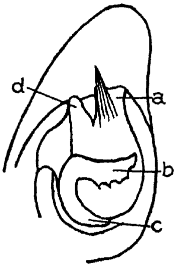

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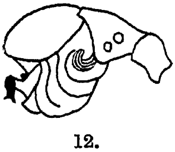

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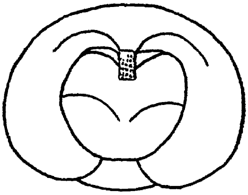

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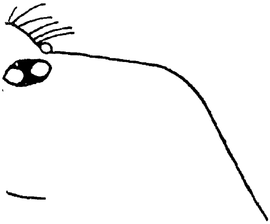

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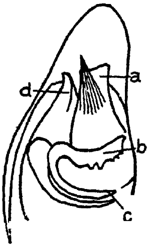

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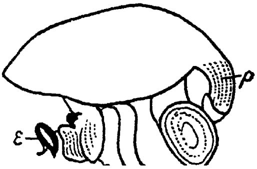

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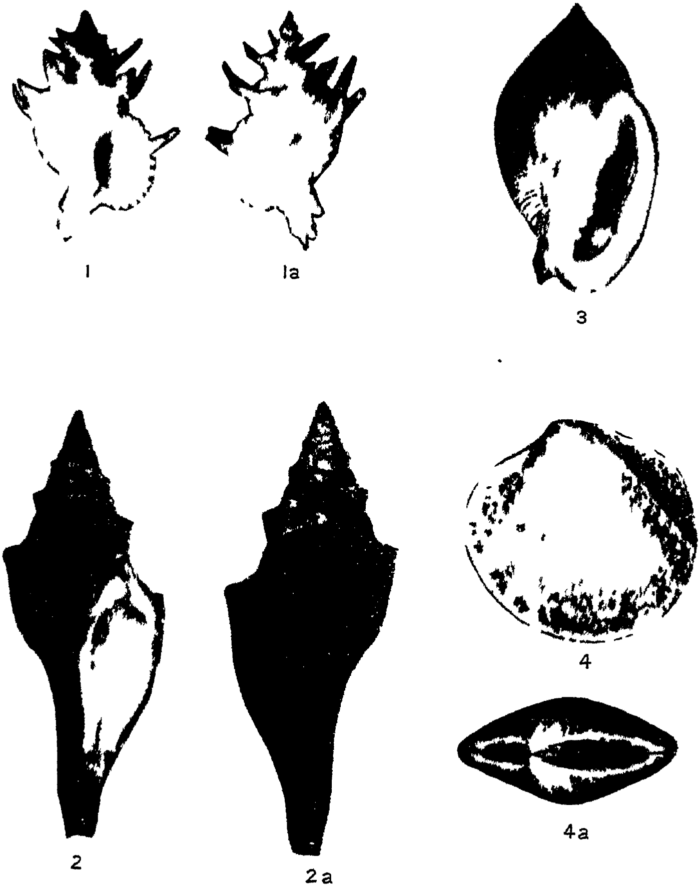

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